THURSDAY, NOVEMBER 20, 1919.

VERTEBRATE EMBRYOLOGY.

Text-book of Embryology. Vol. xi. *Vertebrata with the Exception of Mammalia.* By Prof. J. Graham Kerr. Pp. xii+591. (London: Macmillan and Co., Ltd., 1919.) Price 31*s.* 6*d.* net.

THE second volume of this important text-book of embryology deals with all the vertebrate groups with the exception of the mammalia. It is unnecessary to say that a more highly qualified authority than Prof. Graham Kerr to expound the many intricate problems of the subject could not be found, but what does impress the reader is the clear insight into the depths of these problems that the author has gained by his own detailed and important original investigations.

It is not surprising to find that, in this comprehensive treatise, the archaic but unfortunately inaccessible mud-fish—Lepidosiren—plays a predominant *rôle*, and that our old friends of the embryological laboratory—the chick and the tadpole—are relegated to minor parts; but Prof. Kerr convinces us that this is as it should be.

The highly specialised vertebrates that we can get in abundance for our class work are not the best types in which to search for the clues to the solution of the many problems of vertebrate embryology. It is rather in the more archaic forms with larger histological elements and a primitive anatomical structure—such as the Dipnoi, the Ganoidei, and the Urodela—that the embryologist has found by experience that he obtains his most satisfactory results.

The need for a text-book of this description which deals fully with the fundamental problems of embryology, as distinct from a text-book that deals only with the development of a few selected types, has long been felt, and a brief reference to one or two of these problems may be given to indicate the manner in which the author expounds them in the light of modern embryological research.

There has been no more highly controversial problem in embryology than the question of the origin of the nerves from the central nervous system. Prof. Kerr describes in some detail the result of his own researches on the development of the motor nerves of Lepidosiren, and gives a critical summary of the theories of His, Balfour, and Hensen. His own opinion is finally expressed and may be very briefly indicated by the following sentence (p. 111): "It is suggested that the development of the actual nerve fibril is simply the gradual coming into view of a pathway produced by the repeated passage of nerve impulses over a given route."

The origin of the paired appendages of vertebrata is another of these debated problems on which distinguished morphologists have held very divergent views. Here, again, the author sets before the student the "branchial theory" associated with the name of Gegenbaur, and the continuous "lateral fin" theory which was supported by Balfour, before expounding his own views in what he calls the "external gill hypothesis." This hypothesis is based on the supposition that the external gills extended further back than they do in any living vertebrate, and that, being potential organs of support, and also potential organs of movement, as indicated by their flicking movements in some existent larvæ, they became transformed into purely locomotive and supporting paired appendages. The limb girdle on this hypothesis is a modified branchial arch skeleton, shifted backwards as in the theory of Gegenbaur.

With the lateral fin theory already so well established in this country, it is not likely that Prof. Kerr will find his views in this matter generally accepted, but there is so much that is interesting and ingenious in the way in which his hypothesis is expounded that the student must benefit by its careful consideration. There are many other problems of absorbing interest, to which space does not permit us to refer, discussed in the spirit of just consideration of the views of previous writers, and a clear expression of the author's own opinion. This is the feature which commends the volume most strongly to the student who is capable of appreciating something more than a plain statement of the facts that have been discovered.

But a word of high praise must also be given for those parts of the work that are purely descriptive. It is always a difficult matter to condense into the allotted space the main results of exhaustive researches, but Prof. Kerr has accomplished this part of the task with great skill and judgment. In some cases, perhaps, a little more expansion would have been advisable. For example, in the chapter on the development of the brain a fuller explanation, with a figure, of what is meant by the term "Archipallium" would be most useful, or, again, in the description of the development of the vertebral column of Sphenodon, in which the student, puzzled by the myotomes being opposite to the protovertebræ in Fig. 152 C, but alternate with them in Fig. 152 B, will find no key to the puzzle in the text. But minor criticisms such as these seem out of place in reviewing a book which has so many merits.

We are glad to find that in writing this text-book Prof. Kerr has not withheld from us the fruits of his ripe experience as a teacher and investigator, for we find in chap. x. a most excellent general account of the development of the chick, illustrated by many good figures, and accompanied by practical instruction in laboratory methods. This chapter will prove to be of great value to the beginner and to his teachers. Moreover, in the last two chapters we are given most interesting and useful comments on the practical study of the embryology of the lower vertebrata and on the guiding principles of embryological research. Prof. Kerr has rendered a great service to scientific students by the publication of this

volume, a volume which undoubtedly will take a high rank among modern text-books of zoological science. It is something better than a mere text-book of embryology, as it deals very fully with many of the most important principles of biological philosophy, and will prove very useful as a guide for practical research work in other branches of zoological science. S. J. H.

THE RARER ELEMENTS.

(1) *The Analysis of Minerals and Ores of the Rarer Elements for Analytical Chemists, Metallurgists, and Advanced Students.* By Dr. W. R. Schoeller and A. R. Powell. (Griffin's Scientific Text-books.) Pp. x+239. (London: Charles Griffin and Co., Ltd., 1919.) Price 16*s.* net.

(2) *The Metals of the Rare Earths.* By Dr. James Frederick Spencer. (Monographs on Inorganic and Physical Chemistry.) Pp. x+279. (London: Longmans, Green, and Co., 1919.) Price 12*s.* 6*d.* net.

THE two volumes before us, taken together, form a very complete treatise on the rarer elements, their occurrence, properties, and the methods for their separation. Although they overlap in some measure, each contains much information of the highest importance at the present day.

The practical value of many of the rarer elements has recently been brought into prominence, and it is becoming increasingly plain that, locked up in these little-known minerals widely distributed over the earth's surface, there are elements possessing properties of hitherto unrealised value and importance.

Radium has shaken the old conceptions in chemistry and physics to their very foundations. Uranium, tungsten, tantalum, molybdenum have given us steels which have profoundly influenced the engineering trades and the production of artillery. Thorium and cerium have preserved the gas industry as a means of illumination. Cerium and the rare earth metals rendered us almost independent of the lucifer match. These are but a few indications of the potential value of the rarer elements.

(1) This volume, which naturally comes first, deals exhaustively with the minerals from which the rarer elements are derived, and gives very clear and practical instructions for their recognition, and the properties, chemical reactions, and method for separating the elements. The design of the work is distinctly original, and the authors have included as much trustworthy information about each element as is available at the present time, together with descriptions of the spectroscopic, magnetic, electroscopic, and other apparatus used in research. It is abundantly clear that they have a very practical acquaintance with their subject; novel chemical and physical reactions are given that are apparently taken direct from the laboratory note-books.

The elements are taken in the order of their groups in the periodic system, and the text is arranged under two headings—"General Information," which includes spectroscopic and other physical reactions; and "Mineral Analysis," including qualitative and quantitative estimations and chemical reactions.

There is no general index, but in its place two lists are produced, one giving the names of nearly two hundred minerals containing rare elements, and the other the various methods for separating them from the bodies most frequently accompanying them.

A table of atomic weights and gravimetric factors is included.

(2) The title of this volume strikes one as a little inappropriate, for the metallic properties of the rare earth elements are those about which least is known, but the author is to be congratulated upon having collected together the essential details of all that is known in the domain of the "Rare Earths."

This field has a fascination of its own, quite apart from any utilitarian considerations; that is only realised by those who have worked in it; so great is that fascination that it has claimed the best energy of some of the most honoured men of science. Berzelius, Nilson, Clevé, Lecoq de Boisbaudran, Delafountain, Moissan, Crookes, Urbain are only a few that have fallen under the spell of the "Rare Earths." The work, hitherto exceedingly difficult on account of the rarity of the minerals needed, has been greatly facilitated by the development of the "mantle" industry, because in the extraction of the very large quantities of thorium and cerium needed for that purpose, all the members of the rare earth group are thrown out as by-products, and can be procured with comparative ease.

The substantial monograph under notice is an advance upon any of the excellent works that have recently appeared on the subject. The most remarkable feature in the volume is the great number of references to authorities that are given; these number as many as 1029, and will be found of very great value to the student, enabling him easily to consult the original memoir.

The author's remarks, though good, are sometimes liable to be misleading; in this connection we notice that, in reviewing the work of the late Sir William Crookes on the rare earths, and the suggestion there put out as to the possible existence of "meta-elements," the author states on page 7 that Crookes, by fractional precipitation, obtained seven fractions of different basicity which had different absorption spectra, which he called meta-elements. This may be a clerical error by the use of the term "absorption" instead of "phosphorescence," for the matter is quite correctly stated on page 66.

In point of fact, Crookes's contention was that the purest yttria obtainable gave under the cathodic discharge, *in vacuo*, a discontinuous spectrum consisting in numerous more or less nebulous coloured bands, and that by fractionating this material it was possible to separate these band-

forming bodies from each other, and it was to these bodies, all components of pure yttria, that he gave the name of meta-elements. This question of the cause of the discontinuous phosphorescent spectra is by no means settled, and offers a field of most interesting research.

The history and analysis of each of the chief rare earth minerals is given, and this is followed by a good description of the various methods of fractionation used for separating the closely associated members of the rare earth groups. The methods of spectroscopic analysis are given, as is also the use of the magnetometer, an instrument only recently applied to these researches.

The cerium and yttrium groups of the rare earths are each separately described, and the latest determination of the atomic weights are given, together with the methods by which they were obtained.

In the discussion of the position of the rare earths in the periodic system the author includes the elements scandium and thorium, which for various reasons are not generally considered members of the rare earth group at all. It is not difficult to find places for these, especially the former, which is undoubtedly the "ekaboron" of Mendeléeff, but the placing of the closely allied bodies of the cerium and yttrium groups remains as big a puzzle as ever.

The final chapter deals with the uses of the rare earth elements; with the exception of cerium, which is absolutely essential to the production of an efficient "mantle," these are not numerous and are comparatively recent. But enough has been said to show the importance and value of the study of the rare earths, and the author's very complete work, taken in connection with that of Messrs. Schoeller and Powell, will aid very greatly in the study of these little-known bodies from which we can confidently expect great results.

J. H. GARDINER.

RACE AND NATIONALITY.

Race and Nationality: An Inquiry into the Origin and Growth of Patriotism. By Dr. John Oakesmith. Pp. xix+300. (London: William Heinemann, 1919.) Price 10*s.* 6*d.* net.

THE thesis which Dr. John Oakesmith maintains in this work is one which concerns anthropologists as well as politicians and historians. His doctrine that the national frontiers of Europe have no racial significance is a truth so apparent that no proof needs to be adduced. Yet it is perhaps well that the fact should again be insisted on at the present time because the public mind is still influenced by the vigorous anthropological teaching of last century, wherein it was maintained that the Saxon and Celtic elements in the population of these islands were of diverse racial stocks. We agree with Dr. Oakesmith that there is no single character or set of characters in body or mind by which an anthropologist can tell an Irishman from an Englishman. The claim for Irish separation does certainly not depend on a difference of race, for both English and Irish are members of the same racial stock, and of the two the Irish are the more representative of the Nordic or North Atlantic race.

The independence of nationality and race, however, is but a minor issue in Dr. Oakesmith's main thesis. This concerns itself chiefly with an inquiry into the nature of nationality. He defines and redefines it in many passages, but the following may be taken as representing his final conclusion (p. 75): "Nationality is a conviction based upon practical realities, upon the facts of historical development, and upon the demands of human experience." This represents rather what he hopes nationality may come to mean in the future, for in the present he recognises that mixed with its rational or utilitarian qualities there are both passions and emotions. Rightly enough, he maintains that if these passions and emotions could be eliminated and only the intellectual conception of nationality left, then wars would cease, and the world would come by the peace it longs for. Such is the main thesis of this book.

Does race, then, play no part in separating and keeping apart the masses of humanity? Dr. Oakesmith seriously maintains that "to envisage race as an operating objective factor in evolution of societies is both unscientific and unphilosophical" (p. 74). He cites the case of the Jewish people in England to prove that "race is a metaphysical conception having no foundation in practical life." "With proper adjustments of education," Dr. Oakesmith solemnly asserts, "you can turn an Oriental Jew into an Occidental Englishman." In other words, were we to substitute a Jewish for a native baby in every cradle of England for a generation, English nationality would remain just what it has been since the Anglo-Saxon invasion. Or, to alter the parallel, if we were to substitute babies from China, Central Africa, or Greenland, England would stand just where she did if Dr. Oakesmith is right. It is unnecessary, in the light of experience to be gathered from every part of the world, where diverse races come in close contact, to do more than say that race, unfortunately, is much more than Dr. Oakesmith supposes it to be—a "metaphysical conception."

A. KEITH.

OUR BOOKSHELF.

Sanitation Practically Applied. By Dr. Harold Bacon Wood. Pp. vi+473. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 13*s.* 6*d.*

THE author of this volume is assistant commissioner to the West Virginia State Department of Health, and he prepared it as a "corollary to the numerous excellent treatises on the theory of hygiene and the laboratory manuals" for the use primarily of the health officer and for the student of public health topics. In the main it is intended for and will best meet the needs of the American worker and student.

Judged from the book alone, it is perfectly clear that Dr. Wood is well qualified to write upon the subject he has taken up. Although some of the subjects are dealt with sketchily enough, he gives the impression that he has had experience; that he has worked in the field; that he has kept his eyes open and knows generally what should be done and how to do it. The American health officer and student of public health topics may very safely take him as a guide. The English health worker even may find something of value in what he has to say, though he has no reference to English works and workers, and his viewpoint is purely American, and his methods, most of them, not such as are or could be applied in this country.

The book is not a large one, but Dr. Wood covers the greater part of the field of health work, dealing with such subjects as statistics; control of communicable diseases; child welfare; school hygiene; pure foods, etc.

The treatment throughout is practical, and the writing is good and attractive. The same may be said of the illustrations, of which there is a fair number. As already hinted, it is unlikely that Dr. Wood's book will have more than a limited appeal in this country, but it will probably receive a good welcome from and be found useful by health workers in the United States.

The Study of the Weather. By E. H. Chapman. (The Cambridge Nature Study Series.) Pp. xii+131. (Cambridge: At the University Press, 1919.) Price 3*s.* 6*d.* net.

THIS little book on elementary meteorology will be welcomed by the school-teacher, to whom it makes its primary appeal. Though the serious student of the science may at first feel that it has no place on his shelves, yet, should he at some time be called upon to lecture to a non-scientific audience, he will find a perusal of its pages of no small value. The matter dealt with is mainly confined to features of the weather which can readily be observed by young people without special apparatus, and it is presumably for this reason that any reference to pressure and temperature conditions in the upper air is omitted. With the foregoing rather notable exception the groundwork of meteorology is well covered. One of the chief features of the book is the series of exercises, of which more than 250 are given. These vary from some very simple questions to others which the teacher would be well advised to think out carefully before putting to his class if he wishes to avoid finding himself in an awkward position. Many of these questions are calculated to arouse a most healthy interest in the minds of the pupils. One example must suffice. "What kind of weather is it that causes the inside walls of a building to stream with moisture?"

The Cambridge University Press is to be congratulated on the clearness of the printing and the excellence of the get-up of the book. The frontispiece is particularly pleasing. Numerous illustrations and charts are included in the text.

J. S. D.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Percussion Figures in Isotropic Solids.

IN the issue of NATURE for October 9, Prof. C. V. Raman, of Calcutta, illustrated the conical fracture produced by the impact of a steel ball on a plate glass surface.

The following observations; which may be regarded as supplementary, were made by the writer some time ago with the object of finding what really happens when a glass surface is being ground, or, as it is technically termed, smoothed by an abrasive such as carborundum. Individual grains of a good abrasive have a nodular form, and the abrasion of glass appears to arise from the impact or pressure of the grains.

Two polished surfaces of glass were placed face to face with a few grains of carborundum between them, and the specimen was compared with a similar one in which steel balls of 1 mm. diameter were substituted for the carborundum. Pressure was applied uniformly over the whole surface, and while the pressure was being applied, the plates could be translated one over the other, thus producing the actual machine conditions. The observations were made by means of a polariscope. As the appearances were identical, steel balls were used throughout the later experiments, thus enabling the conditions to be better controlled.

It will be assumed that the polished appearance of glass is due to an amorphous surface layer. When the surface particles are acted upon by mechanical forces, the molecules, or possibly groups of molecules, rearrange themselves, the result being akin to the surface of a liquid. This conception was first advanced by Lord Rayleigh, and there is now a large mass of supporting evidence. When a piece of glass is worked mechanically, the surface molecules are so profoundly agitated that they are able to rearrange themselves under the action of intermolecular forces.

Fire glazing similarly consists in thermally agitating the molecules. Very small forces are sufficient to weaken the molecular cohesion by the required amount. Chemical action may produce a similar result. An optical surface may be reduced quite uniformly by the action of HF, provided the fluorides as formed are not allowed to crystallise and the bath is kept in continuous movement. When a piece of glass is fractured comparatively slowly, the forces at the edge of propagation of the fine crack must be very great, and, as before, the molecules are able to flow or rearrange themselves to form a polished surface layer. But when the fracture takes place suddenly, and almost explosively, as, for example, in the cooling of a pot of optical glass, portions of the surface may have a matt appearance to the unaided eye. This type of matt surface has been discussed very fully by M. Charles de Freminville, of Paris, who regards it as a type of multiple fracture. This explanation is more probable than the alternative one that the time of fracture is too small to permit of viscous flow.

When a steel ball is pressed lightly on the polished surface of a glass block, the appearance, when viewed between crossed Nicols, is as in the diagram (Fig. 1). The central black cone has an angle of about 20°, which remains practically independent of the pressure of the ball. The cone of strain, *b*, *b* has

an angle of about 90°. Some surface light is visible at *d* and *d*. At low pressures the dark cones *c* and *a* merge softly into *b*. As the pressure is increased, the interfaces become more intense and clearly defined, but the angles do not appreciably alter. The central cone proceeds from the surface first as a rod or filament of a remarkably black intensity.

Further gentle increase of pressure causes the surface layer to rupture as indicated in Fig. 2, which is a photograph of a surface repeatedly ruptured by gentle impact. If the Nicols are paralleled, black rays will be seen proceeding from the edge of the crack as in Fig. 3, their direction indicating that the crack is normal to the surface and merely superficial. The Fig. 1 appearance remains unaltered.

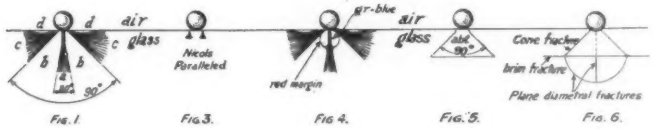


Fig. 1. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

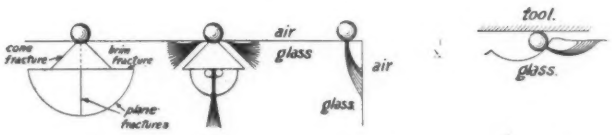


Fig. 7. Fig. 8. Fig. 9. Fig. 10.

A new phenomenon makes its appearance when the pressure is again increased. Immediately under the ball there appears, as in Fig. 4, a sphere pierced by the filament of the cone *a*, and having a black outline tinged with red on the outside. The interior is filled with green-blue light, otherwise the general appearance of Fig. 1 remains unaltered. If now the Nicols are paralleled, the conical fracture (Fig. 5) previously illustrated by Prof. Raman will be seen, and by examination at intermediate positions of the Nicols, it will be evident that the cone fracture which takes place along the surface of *b* is tangential to the sphere which it encloses. The fracture can be extended up to a limit which it is difficult to exceed, even by a great increase of the rate of application of the pressure.

If the pressure is increased again, the crushing point is soon reached. The glass under the ball collapses almost explosively, a faint click being audible, and the ball sinks deeply through the surface. The cavity thus produced is lined with a snow-white layer of powdered glass.

On the polariscope at the moment of fracture several interesting developments may be observed. First, as the result probably of the greater area of pressure contact, the cone of light *b* broadens out laterally; secondly, the cone fracture may extend horizontally like the brim of a hat, thus definitely terminating the depth below the surface; and thirdly, the space within the cone becomes cleft by two fracture planes apparently normal to one another, and having their line of intersection on the axis of the dark cone *a*.

If only one diametral plane appears, the other may be developed by an increase of pressure. Sometimes the second plane is terminated at the axis, but it can always be extended across the first plane. The appearance of the fractures is now as indicated in Fig. 6. If the diametral plane fractures terminate at the base of the cone, they may be extended by pressure to the end of the rim, as in Fig. 7.

Under crossed Nicols two new coloured spheres identical with the original one may make their appearance just under the base of the cone fracture, as in Fig. 8, indicating the existence of subsidiary fractures.

But if a polished transverse section of a glass plate smoothed with carborundum is observed microscopically, it will be seen immediately that surface conchoidal fractures predominate, and that, if cone fractures do exist, they are very shallow.

In the workshop process of smoothing preparatory to polishing, the smoothing tool moves over the glass surface, but movement of the experimental plates did not alter the general characteristics outlined above, nor did the presence of water afford an explanation of the results obtained in practice.

Evidently mere pounding of a glass plate cannot result in a smoothed surface of a technical order.

As in all the previous experiments the pressure was applied at the centre of the block, where the horizontal forces were balanced, a new series was carried out near the margin of the plate. The new appearance, corresponding with the stage illustrated in Fig. 1, is indicated in Fig. 9, from which it will be seen that the central cone is now deviated towards the side, its axis following the characteristic conchoidal section. In other respects the sequence of phenomena was as before. Thus, after the cone fracture which was of a shallower order took place, and the crushing point was reached, the diametral plane fracture followed the axis of the deviated central cone, and the cavity from which the splinter was removed had the characteristic conchoidal appearance.

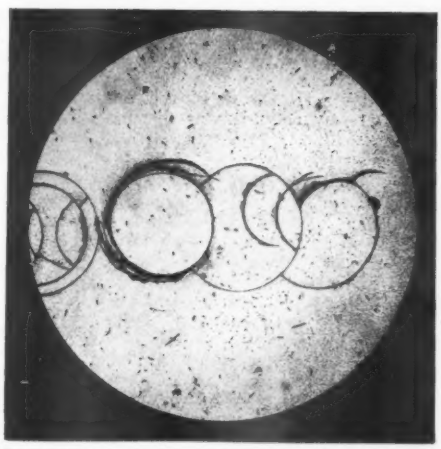


Fig. 2.—Surface percussion cracks on glass. Magnification 42×.

It is presumably the impact of the carborundum grains on the edges of cavities on the glass to be ground that produces the conchoidal splinters as indicated in Fig. 10. It would appear, therefore, that it is the diametral plane fracture that is of primary importance,

and that, in the processes of smoothing, the horizontal movement is required to force the abrasive grains against the sides of the cavities. From actual tests it is found that the rate of abrasion is directly proportional to the pressure and to the relative speed of translation.

JAMES WEIR FRENCH.

Anniesland, Glasgow, October 13.

The Breeding of the King Penguin.

THE Zoological Park at Edinburgh has had the good fortune to possess, almost from its inception, a small group of king penguins. Three of the birds were received in January, 1914, from South Georgia, a second consignment, of which three survived, arriving in the spring of 1917. A hope was excited that they might breed when two of them were observed to be mating in the autumn of 1915, but nothing further occurred at that time. In the late summer of 1917 one of the birds became broody, and sat in the posture of incubation for about a month, but no egg was apparently laid, nor was this bird one of the two which had been observed to be paired. It was not until 1918 that the paired birds really settled down in earnest, and much interest was aroused when, on July 8 of that year, one of them was found to have an egg.

The king penguin, like its near relative the emperor penguin, makes no nest, but carries the single egg on its feet, where it is held in place and covered for warmth and protection by a fold of the skin and feathers of the abdomen, which, being furnished with a constricting muscle, grips the egg tightly. The brooding penguin can not only travel about with the egg in position, but even scratch its head with one foot while still holding the egg securely. Both sexes share in the work of incubation, the transfer of the egg having been observed on the second day. The parental instinct is very strong in the king penguin, not only in mated, but in the unattached birds as well. The group at this time contained three other birds, and their presence, or perhaps nothing but the very obvious conflict of desire for simultaneous possession of the egg between the husband and wife, may have been the cause of the misfortune which followed; at any rate, it was disappointing to find, after about two weeks, that the egg had been broken and that its custodian was believed to be relieving the tedium of duty by occasionally sipping its contents.

The floor of the enclosure consists of shelving rock, and to reduce the risk of breakage if an egg were produced this year, a large bed of sand was laid down. The next incident was again disappointing, for in July an egg was laid, but within an hour or so it had disappeared. As none of the birds showed any disposition to incubate it, I formed the opinion that it had been laid by one of the unmated birds, and this seemed to be confirmed when, on September 1, the female of the pair was found to have an egg. The other three birds were at once removed from the enclosure so that they should not interfere, and for two days all went well, the male bird taking the egg at night and the hen during the day. On the third day, however, the calling of one of the other birds—the third of the three originally imported—seemed to disturb the male, and he left his wife, refused to have anything more to do with the egg, and spent the day (and probably the night) in calling to the third bird and trying to get to it. After some days, as the female seemed to be suffering from the unrelieved care of the egg, and neither bird would feed, it was decided to put the third bird back. When this was done they all settled down together, and the male resumed his share in the labour, the third bird usually standing near.

The time during which each bird had the egg varied from a day to a week or more. The female when she had the egg always remained in the same place, where she made a slight hollow in the sand, but when the male had it he occasionally went for a walk round the enclosure, shuffling along with the egg on his feet. He even descended from one ledge of rock to another by turning round and working himself down backwards—a performance which led to several narrow escapes for the egg.

As the period of incubation elapsed the result was awaited with some anxiety, and it was in no small degree gratifying to find, on October 22, that the egg was chipped and the chick inside alive. It was not, however, until two days later that the chick was clear of the shell, the period of incubation thus being seven weeks and four days. The chick when hatched was comparatively small, and the skin was bare, but in a few days it increased considerably in size. The young bird, like the egg, is kept between the feet of the parent and covered by the fold of skin; it is fed at frequent intervals with semi-digested fish disgorged by the parent. As in the case of other birds which feed their young by this method, the chick places its head in the parent's mouth and takes the food from the gullet.

Apart from accident, there seems every likelihood that the young bird will be reared. It may be claimed which feed their young by this method, the chick king penguin has bred outside those islands of the Antarctic seas on which it has its home, and the record is a unique one.

T. H. GILLESPIE.

Zoological Society of Scotland, Edinburgh,
October 29.

A Helium Series in the Extreme Ultra-Violet.

IT has been shown that the helium series first discovered in a terrestrial source by Fowler can be represented by the formula

$$V = 109750\left(\frac{1}{\left(\frac{n_1}{2}\right)^2} - \frac{1}{\left(\frac{n_2}{2}\right)^2}\right),$$

where n_1 has the value 3 or 4 (Evans, *Phil. Mag.*, vol. xxix., p. 284, 1915).

If n_1 be given the value 2, and n_2 the successive value 3, 4, and 5, lines result at wave-length 1640·1, 1214·9, and 1084·7. My previous investigations of the helium spectrum did not afford much evidence as to the existence of these lines (*Astrophys. Journ.*, vol. xliii., p. 92, 1916); a recent search, however, has been more successful. With a powerful disruptive discharge in helium, a sharp, fairly strong line appears at 1640·2; no trace of it is found in hydrogen under the same electrical conditions, and it does not occur in helium when the discharge circuit is free from capacity. Under the same violently disruptive condition the line at 1216, always present in helium and hydrogen, develops a satellite on its more refrangible side; this satellite is not well resolved, but its wave-length appears to be about 1215·1. The region that should be occupied by 1084·7 is obscured by a strong pair at 1085, probably due to an impurity.

Owing to the difficulties of vacuum spectroscopy, it is perhaps unwise to claim that the evidence in this case is conclusive. I regard it as very probable, however, that two members of this series in helium have been found in the extreme ultra-violet.

THEODORE LYMAN.

Harvard University, October 25.

Variations of Refractive Index.

EXPERIMENTS conducted in the research laboratory of the firm of Adam Hilger, Ltd., by Mr. G. M. Fleming show that, in certain circumstances, distinct differences of refractive index may occur in certain liquids at the separating surface between the liquid and a polished glass surface. In a few exceptional cases the differences are very great; in the case of ether, for instance, they may amount to as much as 0·02 in the refractive index.

These results appeared to me of considerable importance, and it was intended that the investigations should be continued here.

As a first hypothesis, I proposed to assume that the effect was due to variations of pressure in the neighbourhood of the interface, such variations of pressure being due to cohesion, and occurring according to the intimacy of contact between liquid and glass. Very attractive lines of thought suggest themselves when the phenomenon is contemplated from this point of view.

Unfortunately, more urgent preoccupations intervened, and the results have therefore been communicated to the director of the British Scientific Instrument Research Association, in the hope that he may find a place in the programme of work for further study in this direction. Meanwhile, I should be grateful if any of your readers could refer me to any prior observations of the kind. F. TWYMAN.

Research Department, Adam Hilger, Ltd.,
75A Camden Road, N.W.1, November 7.

The Audibility of Thunder.

FROM reading a recent letter in NATURE (October 16) discussing the distance that thunder can be heard, I am induced to send you the following observation:—On the evening of February 26, 1912, when camped on North Chincha Island (off the west coast of South America), a brilliant display of lightning in the distant high interior to the east attracted our attention. The cloud-stratum from which the storm evidently issued lay far behind the clear coastal zone and the lower foothills, but hid from my camp the upper regions of the Cordillera. Both I and a Peruvian friend heard quite clearly the low distant peals of thunder. As I had been told that thunder was an almost, if not a quite, unknown phenomenon on the coast—this was the first thunderstorm, indeed, that my companion, a man of more than forty years of age, had experienced—I purposely made a record, during the best part of an hour, of the intervals elapsing between the flashes and the peals, and from my journal I find the average to have been 320 seconds. HENRY O. FORBES.

Beaconsfield, Bucks, November 7.

Linkage in the Silkworm: A Correction.

IN referring to Tanaka's work on silkworms I made (NATURE, November 6, p. 216) a mistake which should be corrected. His discovery was not that two characters linked in the male were not linked in the female, but that in a case of linkage common to both males and females it is only in the males that crossing-over occurs. Since, on the analogy of Abraxas, the female is presumably in the silkworm the heterozygous sex, this observation is complementary to and consistent with Morgan's evidence that in Drosophila there is no crossing-over in the male, which in that animal is heterozygous in the sex-character. The paper is in Journ. Coll. Agr., Tohoku Imp. Univ., vii., 1916, pt. 3. Also the forms found by Patterson associated with males and females should have been called "asexual," not "inter-sexes." W. BATESON.

November 14.

THE PREHISTORY OF SOUTH AFRICA.[1]

THE bulk of Dr. McCall Theal's book is as valuable now as it was when first issued, twenty years ago. But though "illustrated and enlarged," it is not "improved" so much as one would have expected. Dr. Theal does not make much use—though he alludes to its publication in 1911—of Dr. Péringuey's important study of the Stone age in South Africa, though the theories of Péringuey and Shrubsall would have materially helped him in his attempts to picture the first peopling of South Africa by Man. Also, in the scanty evidence he has gathered together of the origin and wanderings of the Bushman race he—as do most other historians of Africa—overlooks the statement of the Italian traveller, Ludovico di Varthema, who in his 1508 voyage across the Indian Ocean stopped at Mozambique, and, journeying a short distance inland to some table-topped mountain, described a short-statured savage people living on the mountain-top whose language consisted largely of "clicks," "like the sounds used by Sicilian mule-drivers." I have myself gathered up and recorded legends in South

(*a*) (*b*)

FIG. 1.—Drawings of the skulls of two Strandlooper types: (*a*) the oldest and most like to the Hamite or the Cro-Magnon of Europe; (*b*) a Strandlooper skull that is very Bushman-like. The originals are approximately the same size.

Nyasaland of a yellow-skinned, Bushman-like tribe that lived down to a few hundred years ago on the inaccessible upper parts of Mts. Mlanje and Chiperone.

So far as we can trace the race movements in Africa south of the Zambezi prior to the definite entry of South Africa into recorded history, we find them to be something like this: At a comparatively remote period—say, thirty to twenty thousand years ago—there was living in southernmost Africa a human type now named or nicknamed the Strandloopers ("shore-runners"), whose skulls show a slight resemblance to the Bushman type, but whose brain capacity was much higher (1600–1500 c.c. in the male, compared with an average of 1200 c.c. in the Cape Bushman, and an average of 1480 c.c. in the Bantu-speaking Negroes). The higher type of Strandlooper skull (*a* in Fig. 1) in fact reminds one of the Hamitic skulls of North-east Africa or of the Cro-Magnon type of Europe thirty thousand

[1] "Ethnography and Condition of South Africa before A.D. 1505." By Dr. George McCall Theal. Second Edition in the Present Form (Illustrated), Enlarged and Improved. Pp. xx+466. (London: George Allen and Unwin, Ltd., 1919.) Price 8*s.* 6*d.* net.

years or so ago. These scarcely Negroid Strandloopers, according to Péringuey, were the earliest humans in South Africa, so far as our very slight evidence can be applied to the making of theories. But apparently, though they brought with them the European arts of their time, and especially

FIG. 2.—A photograph of the Nile Delta pygmy type of (?) 8000 years ago from a pre-dynastic "slate palate."

their gift of drawing, they imparted some of these to the Bushman mind and then died out.

Another question hinted at, but not adequately discussed, in Dr. McCall Theal's book is that of the different physical types of Bushmen. There is a Bushman language and culture common to all these (degraded or primitive) peoples, but the

FIG. 3.—A photograph of a very old Cape Bushman.

shape of the head differs considerably. Some—Dr. Theal gives a photograph of a woman—exhibit a greater degree of prognathism than any other known human race. I could supplement Dr. Theal's example by several others, not, unfortunately, at my disposal for reproduction at this moment. The North Kalahari Bushmen have sometimes projecting brows; the Cape Bushmen, on the other hand, are usually neither prognathous nor prominent-browed. Some Bushmen have fairly long skulls; others have head-forms markedly round and brachicephalic. Possibly these varieties in the shape of the skull may indicate a fusion of Negroid types, some of which stood low in the scale of humanity, especially in language. There are apparently two features (besides steatopygy) characteristic of the Bush race which all these varying types hold in common: one is the configuration of the ear, and the other is peculiarities in both the male and female external genitalia. I do not know whether the "Bushman ear" has been definitely noted in other Negro or Negroid races, but the peculiarities of the genitalia can be noted here and there up the eastern side of Africa until the eastern Mediterranean is reached.

The Bushmen, indeed, seem to have entered

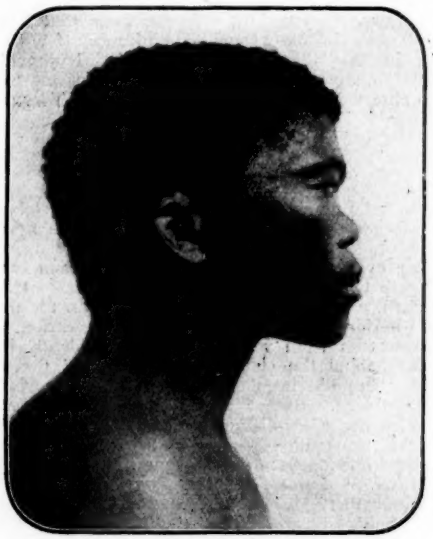


FIG. 4.—Head of a North Kalahari Bushman.

Africa—no doubt very anciently—from the direction of Arabia or Syria, and to have wandered down the eastern side of the continent until they settled in South-east and South-west Africa.

The Hottentots came very much later—the forest Negroes and the Nilotics may have preceded them in East and South-west Africa. They arose probably from a blending somewhere in eastern equatorial Africa between the Bushman type, the Hamitic or Nilotic Negroids, and the forest Negroes. Their push southwards seems to have been diagonal, first from the regions south of the Victoria Nyanza to the Nyasa-Tanganyika plateau, and thence to South-west Africa. Finally, they advanced along the coast of South-west Africa to the lands south of the Orange River. Like the Bushmen, they formed tribes that differed much in facial appearance. Those that the Portuguese and Dutch found established

in Cape Colony were lighter in colour and far less ugly than the Hottentots farther to the north-west or inland, and their culture was higher, as though they had preserved more of the Nilotic or Hamitic intermixture.

The pygmies of the Nile Delta, of prehistoric Egypt, seem certainly to have been Negroid, but more like the Asiatic Negroes, and presenting few resemblances to the Bushmen. The steatopygy of Bushmen and Hottentots developed into a local exaggeration (chiefly in the women), but occasionally appears in the Congo pygmies, the East African Bantu, the Nilotic Negroes, and even the Whiteman races of the Mediterranean.

I cannot quite share Dr. Theal's theories concerning the origin of the Bantu languages, but as I have already exceeded the space allotted to me, I must deal with my points of difference elsewhere. On the other hand, I am obstinately in agreement with his views on the subject of the earlier stone buildings of South-east Africa, of the Zimbabwe type; they were never (the earlier and more elaborate) built by Negroes, Bantu or Hottentot; they were—so far as we can be certain on any subject that has not at present conclusive proof—built by a non-Negro people, possibly the Phœnicians coming from some base in southern Arabia. The secondary and much later work was very likely done by Arab gold-seekers prior to the Islamic period. All that the more intelligent Bantu peoples, such as the Karaña or their allies, did on the verge of their entry into the history of South Africa was to carry on very clumsily surface gold-mining and the use of stone for building rough, low walls and circular huts.

FIG. 5.—Portrait of a Cape Bushman of the orthognathic type.

The accompanying reproductions illustrate my own as well as Dr. Theal's theories. The first is copied from Péringuey and Shrubsall's "Stone Age in South Africa"; the second was given me by Prof. Flinders Petrie; the third by Mr. Leo Weinthal; the fourth is from a photo by Dr. Leonhard Schultz; and the fifth is from the collection of the Royal Anthropological Institute.

H. H. JOHNSTON.

LT.-COL. B. F. E. KEELING.

BY the death of Lt.-Col. Keeling Surveyor-General of Egypt, that country has lost one of its ablest officials. Lt.-Col. Keeling was born in 1880, and educated at Bradford Grammar School and at Trinity College, Cambridge, where he took firsts in the Natural Sciences and Mechanical Science (Engineering) Triposes. On leaving Cambridge he went to the Royal Arsenal, Woolwich, and then to the National Physical Laboratory, where he worked especially on metrology.

In 1904 Keeling joined the Egyptian Survey Department, where he took charge of the major triangulation, and in the next year of the Helwan Observatory also. Here he designed and built the comparator houses for the comparison of the standards of the Survey, and organised the geodetic survey of Egypt, in connection with which a gravity survey of the Nile Valley and neighbouring regions was undertaken. He also started precise levelling in Egypt, and under his direction a network of bench-marks has been formed in the Delta of the greatest value to irrigation. An investigation into the subsoil water-level of the Nile Valley, and its effect on the cotton crop, came also under his direction, while his work on standards of length led to the formation of the Weights and Measures Office under his direction.

In meteorology Keeling introduced research on the upper air at Helwan Observatory, where kites and pilot balloons were regularly used, and in 1908 he made a journey to the Upper Nile for the study of the upper-air currents during the rainy season. In 1913 the more scientific branches of the work carried out in the Survey Department were amalgamated to form the Physical Service, with Keeling as director, and in 1915 this service was transferred to the Ministry of Public Works as a separate Department.

In December, 1914, Keeling left Egypt in order to take up military duties, and received a commission in the Royal Engineers. He was at first attached to the Ordnance Survey, and placed in charge of the map publication department; but it was his keen desire to serve at the front, and in February, 1916, he joined a Field Survey company in France. He was wounded in the autumn of 1916, and did not return to France until 1917, when he commanded first the Depôt Field Survey Company, and then the 3rd Field Survey Battalion; he was promoted to the rank of lieutenant-colonel. The Survey battalions were now organ-

ising new methods of ranging by sound and observation, and by his force of character Keeling was particularly successful in gaining the confidence of the artillery in these methods, and it would be difficult to over-estimate the effect on many operations which he thus exercised. He was present at the Somme battle, the attack on Cambrai, the great German attack in 1918, and the subsequent British advance.

Keeling returned to Egypt in April, 1919, as head of the Survey of Egypt, having also been appointed chairman of the newly formed Board of Cotton Research, and with his accustomed zeal had already started to develop geodetic and other lines of work in the Department. He was a man of unbounded energy, who combined foresight and skill in administration with a sound scientific training, and his loss is a serious one to Egypt. He had only recently been married, and the sympathies of all are with his widow.

H. G. LYONS.

NOTES.

A CONFERENCE of delegates representing the Mediterranean nations is about to meet at Madrid to organise an international scheme of fishery investigations and to set up a central office for the co-ordination of the results and their publication in French, Spanish, Italian, and English. Four exploring ships are to be at the disposal of the office—the *Hirondelle II.* belonging to the Prince of Monaco, a specially built Italian ship, and two other vessels provided by France and Spain. In the meantime, while the full scheme is being elaborated, the Italian Government is beginning investigations in the Dardanelles. In the main, the object of the researches will be the development of the sea-fishing industries, and the results primarily sought will relate to the life-histories of edible fishes. Hydrographic work will also be carried out. Several big expeditions have made investigations of this nature in the past, but there is still much to be discovered, and sustained research is, of course, imperative in the study of variability of the productivity of the fisheries.

WE note with great regret that Mr. S. D. Chalmers died on Friday, November 7. Born at Wallsend, near Newcastle, New South Wales, Mr. Chalmers had a brilliant career at the University of Sydney, whence a travelling fellowship took him to Cambridge. There he graduated as thirteenth Wrangler in a very strong year. After holding lecturerships in mathematics at Owens College, Manchester, and at the Royal Naval College, Greenwich, he became the first head of the newly organised department of technical optics at the Northampton Polytechnic Institute at Clerkenwell, a post which he held until his premature death at the age of forty-two. Since 1903 Mr. Chalmers's work had been entirely devoted to optics, and his activities were largely identified with the Optical Society of London, of which he was for a time honorary secretary, and in 1909–10 president; and also with the two Optical Conventions of 1905 and 1912. His published work, his teaching, and his personal advice and example have done much for the optical industry of this country, and it is greatly to be regretted that one of the ablest workers in this field has been lost to us at a time when that industry needs all its strength. During the war Mr. Chalmers not only assisted the industry by personal advice and help, and by a large amount of responsible testing work, but he also organised and supervised a special training workshop in which girls were trained to become skilled grinders and polishers of lenses. There can be no doubt that his untimely death is to be ascribed to the excessive strain of these activities, followed by the further strain arising from a combination of a pressure of many students and an inadequacy of staff.

ALL those interested in the afforestation question in this country, and cognisant of the vital economic and social problems bound up with it, will have been relieved at the answer given by Mr. Bonar Law, in reply to Sir Philip Magnus, on the subject of the Commissioners to be appointed under the Forestry Act. It will be remembered that the Forestry Bill was passed by the House of Commons in August last, having been previously accepted by the House of Lords. The Act provided for the appointment of a Central Forestry Commission, consisting of eight Commissioners who should be responsible for the forest policy in Great Britain and Ireland, and anxiety as to the non-appointment of the Commissioners was being felt. The names of the eight Commissioners were announced in last week's NATURE. The member of the Commission who has had a technical and scientific forestry training is Mr. R. L. Robinson, the Cabinet having accepted the principle that at least one Commissioner should possess a scientific training in forestry. We should like to have seen a representative of the purely scientific side of forestry upon the Commission, and also a second expert member possessing a practical and wide knowledge of forestry conditions throughout the British Empire and other parts of the world outside western continental Europe. The advice such a member could tender on many points of vital importance in connection with the afforesting of the great waste areas in this country would prove invaluable. This is a weak spot in the Commission, a disability which, it may be hoped, will be quickly realised by such a broad-minded, energetic, and capable administrator as the chairman, Lord Lovat, has already proved himself to be. In other respects the selection of the Commissioners gives every promise of assuring the fulfilment of the desired results.

WE much regret to record the death, on November 14, at eighty years of age, of Dr. John Aitken, F.R.S., a frequent contributor to our correspondence columns, and distinguished for his lifelong researches on the nuclei of cloudy condensation and related subjects of meteorological physics.

THE ninety-fourth course of juvenile lectures founded by Faraday at the Royal Institution will be delivered this Christmas by Prof. W. H. Bragg on "The World of Sound."

ANNOUNCEMENT is made in the *Times* that Prof. M. Planck, Berlin University, and Prof. H. Stark, Griefswald University, have been respectively awarded the 1918 and 1919 Nobel prizes for physics, and Prof. F. Haber, Berlin University, the 1918 Nobel prize for chemistry.

PROF. WM. BERRYMAN SCOTT, president of the American Philosophical Society, sends us the following congratulatory message from Princeton:—"I am very glad to congratulate you, officially, upon the completion of the first half-century of NATURE'S career, to express the cordial wish and hope that that career may long continue in ever-increasing honour and usefulness, and to give some appreciation of the very great services which the journal has rendered to

scientific men throughout the world, especially to those of the English-speaking lands."

THE second annual general meeting of the British Association of Chemists was held on November 15 in Manchester, Prof. J. W. Hinchley, the president, presiding. The council is giving much thought to the important question of the representation of chemists and technical workers generally on the joint industrial councils formed under the Whitley scheme, and was able to report that, as a result of the labours of its special sub-committee, a federation of scientific and technical organisations has been formed for the purpose of advancing the claims of brain-workers to representation alongside capital and labour.

APPLICATIONS are invited by St. Bartholomew's Hospital Medical School for election to the Rose research fellowship, which is of the yearly value of 600*l.*, exclusive of laboratory expenses. The subject of the research is "The Pathology and Treatment of Lymphadenoma." The person appointed must devote the whole of his time to the fellowship. Applications, with not more than three testimonials, the names of three referees, and particulars of the lines upon which the applicant's proposed research is to be carried out, must reach the Dean of the school not later than December 15 next.

THE retirement of Mr. George A. Macmillan from the honorary secretaryship of the Society for the Promotion of Hellenic Studies should not be allowed to pass without notice in these columns. It was on Mr. Macmillan's initiative, due to the enthusiasm for Greek art and archæology kindled by a visit as a young man to Greece, that the society was founded forty years ago, and during those forty years he has acted as its secretary and been the mainspring of its activities. He has worked in close partnership with all the leading Greek archæologists of this generation, encouraged numberless young men, and afforded generous financial assistance to many enterprises. He is a shining example of one who, having put his hand to a task, does not weary in well-doing, but carries it on through the working years of a lifetime. Even now Mr. Macmillan is not wholly withdrawing from the work of the society, for in vacating the secretaryship he has accepted the honorary treasurership, and his counsel will still be available for the cause for which he has done so much.

BARON ROLAND VON EÖTVÖS, Hungary's greatest man of science, died on April 8 last in Budapest. The son of the Hungarian writer and politician, Baron Josef von Eötvös, he was born at Buda on July 27, 1848. He began his university career at the University of Budapest, and continued his studies under Kirchhoff, Helmholtz, and Bunsen at the University of Heidelberg. He also spent a short time at Königsberg under Franz Neumann. Having obtained the degree of doctor of philosophy at Heidelberg, von Eötvös became a *Dozent* in physics at Budapest University, and in 1872 he was elected to the chair of theoretical physics at that university. Some years later he was also elected to the chair in experimental physics, and for a short period was Minister of Education in Hungary. Von Eötvös occupied the position of president of the Hungarian Academy of Science for many years, and in 1891 he founded the Hungarian Mathematical and Physical Society, the presidency of which he held until his death. He was also the Hungarian representative of the International Commission for earth measurement.

THE Hunterian Society celebrated its centenary on November 12 by a dinner at the Trocadero Restaurant. Dr. Langdon Brown, the president, was in the chair, and Sir Norman Moore (the president of the Royal College of Physicians), Dr. Addison, Sir George Newman, Sir Archibald Garrod, and Sir Frank Dyson (the Astronomer Royal) were among the guests. The society's annual silver medal was presented to Mr. John Adams for his work in connection with the Corporation of London's Thavies Inn clinic for the treatment of expectant mothers and their infants affected by syphilis. The Hunterian Society was founded in 1819 by Sir Thomas Blizard, an admirer of the Hunters, and especially of John Hunter, and has numbered among its presidents Dr. Bright (from whom Bright's disease derives its name), John Hilton (the surgeon), Hughlings Jackson, and Sir Thomas Crosby (a former Lord Mayor). In earlier days consultants resided mostly within the City boundaries, and the society has always kept in touch with the City of London, and resolved to make to Mr. Adams a special centenary award of its medal.

THE British Cotton Industry Research Association was formed some months ago to promote scientific research in connection with the cotton industry, in co-operation with the scheme of the Government Department of Scientific and Industrial Research. The first problem before the association after its incorporation was to secure the services of a man of the highest attainments, who would be able not only to undertake the direction of the association's researches, but also in the difficult initial stages to construct sound foundations for the building up of the institute of the future. As mentioned last week, the council has made this appointment, and by securing the services of Dr. A. W. Crossley, C.M.G., F.R.S., Daniel professor of chemistry at King's College, London, as director of research, the association is making a very fortunate and promising start. In his new post Dr. Crossley will be responsible to the council for the direction of all the research and for the whole internal management of the institution. It will probably not be possible for him to devote his whole time to the work before Easter, but he will no doubt be able to give the association preliminary assistance before then.

THE President of the Board of Agriculture and Fisheries (Lord Lee of Fareham) has now approved of the reorganisation of the Board and the regrouping of its functions into five main Departments, each under an executive head responsible, in the case of the three Agricultural Departments, to the President direct, and in the case of the Fisheries and Welsh Departments to the President through the Parliamentary Secretary (Sir A. Griffith-Boscawen, M.P.). Sir A. Griffith-Boscawen, in addition to his duties as Parliamentary Secretary, has been appointed Deputy-Minister of Fisheries. The following appointments have also been made:—Sir A. Daniel Hall, Chief Scientific Adviser to the Board and Director-General of the Intelligence Department; Mr. Lawrence Weaver, Chief Commercial Adviser to the Board and Director-General of the Land and Supplies Department; Mr. F. L. C. Floud, General Secretary to the Board and Director-General of the Finance and Economics Department; Mr. H. G. Maurice, Fisheries Secretary and Principal Assistant Secretary to the Board; and Mr. C. Bryner Jones, Welsh Secretary, in special charge of the Welsh Office. Mr. R. J. Thompson and Mr. H. L. French have been appointed Assistant Secretaries to the Board to fill the vacancies created by the promotions of Mr. F. L. C. Floud and Mr. H. G. Maurice.

In continuation of the excellent work left unfinished by the late Major Bendire on the life-histories of North American birds, there has recently been issued by the United States National Museum (Bulletin 107, Washington: Government Printing Office) an instalment devoted to the Nearctic diving birds of the order Pygopodes, prepared by Mr. Arthur Cleveland Bent with the co-operation of numerous well-known ornithologists. This volume affords much valuable and up-to-date information relating to the courtship, nesting, eggs, period of incubation, young, plumages, food, behaviour, breeding range, winter range, migrations, egg-dates, etc., of thirty-six species, one-third of which are members of the British avifauna. Among the mass of important and interesting information afforded only a few items can be referred to. It may be mentioned that the comparatively little known large-billed puffin, the haunts of which are confined to a limited portion of the Arctic Ocean, has recently greatly increased in numbers on the north-west coast of Greenland, which is regarded as being the westerly limit of its range. Welcome particulars are given relating to the life-history of the yellow-billed loon or Adam's diver, the eggs and nest of which are figured. There is also an excellent summarised history of the extinct great auk, and a figure of the egg, now in America, which was formerly in the collection of the late Sir William Milner, Bart. The author is to be congratulated on the able manner in which he has presented the results of his studies of the extensive and valuable material at his disposal, and also on the interesting series of pictures of bird-life, about eighty in number, from photographs taken direct from Nature. The volume is further enriched by thirteen coloured plates of eggs.

Messrs. Macmillan and Co., Ltd., have in preparation a "Dictionary of Applied Physics," to be issued probably in four volumes, under the editorship of Sir Richard Glazebrook, who will have the assistance of a number of distinguished contributors. The work is intended to include the range of physical science in its application to engineering and manufacture; it will cover, therefore, a wide ground, and needs the co-operation of many writers. It should appeal to many workers, for the fact that scientific investigation and inquiry form the foundations of new methods of manufacture and are required before any marked advance is possible is now very fully realised. It is hoped, in the various sections of the Dictionary, not only to supply up-to-date information as to what has been done in the past, but also to give some indication of pioneering directions for further progress. The present is a suitable time for such a work; new industries are springing up, old industries are being reconstructed, and there are few which do not involve some process or processes based on the discoveries of physics. Pure science, as the president of the Royal Society stated some little time back, may cause a revolution in an industry. It will be the object of the Dictionary to indicate in a concise form the application of the most recent advances of physics to trade and manufacture.

We have received a catalogue of X-ray and electro-medical apparatus from Messrs. Watson and Sons, Ltd., comprising 369 pages, well illustrated. The whole range of appliances, radiological and electrical, now in use for therapeutic and diagnostic purposes is covered, together with numerous parts of apparatus suitable for research purposes. Prominent among the latter are high-tension transformers which the modern investigations in radio-metallurgy have demanded. Useful information is also to be found in these pages as to the careful use and appropriate technique of many of the appliances, as witness the remarks upon intensifying screens and the management of the various types of Coolidge tubes now available. A considerable section is devoted to stereoscopy; fluoroscopic examinations embodying stereoscopic vision are now possible with comparatively little addition to the installations generally found in a hospital department.

Mr. Roger T. Smith gave his presidential address to the Institution of Electrical Engineers on November 13. As the railways of this country are shortly to be subjected to fresh legislation, the choice of a railway electrical engineer as president was a happy one. Mr. Smith considered the question of superseding the steam locomotive by the electric locomotive both for passenger and goods services. The coal necessary to produce a given hauling effect on the railway by means of an electric locomotive is at the most 40 per cent. of the coal burnt in the furnace of a steam locomotive to produce the same result. This would mean a saving of between 7,000,000 and 8,000,000 tons of coal each year. It has been estimated that to electrify all the railways in Great Britain would cost 300,000,000*l*. If coal ever rose to 45*s*. per ton, the saving of fuel would itself pay 5 per cent. on the investment. The average cost of running a locomotive in 1913 was 1240*l*., the cost of coal and water being about 37 per cent. of the total cost. The average capital cost of a steam locomotive this year is 7000*l*., but the average cost of an electric locomotive, including electric equipment of line, but exclusive of power-house and high-tension lines, would be about 35,000*l*. Mr. Smith calculated that to enable the electric train to earn the present revenue per train-mile, the passenger electric train would have to weigh more than half as much again as the steam train, and the electric goods train would have to be at least 1000 tons in weight, which is much heavier than the average steam train for goods. He considered only main-line electrification, and he admitted that some of his data are controversial. He emphasised the importance of standardisation in main-line electrification, and, judging from our present knowledge, he suggested that the direct-current system, working at 1500, or possibly 3000, volts, would be the most economical for use over the whole country. The problem is of the greatest national importance. In the future the demand for scientifically trained traction engineers will be very great.

The annual report of Lloyd's Register of Shipping for the year ending June 30 last is discussed in the *Engineer* for October 31. During the year 1251 vessels of 3,801,221 tons gross were classified by the committee, including 294 vessels for Government service. The United States headed the list with 470 vessels of 1,883,759 tons. Included in the total were 156 vessels of 943,487 tons built upon the Isherwood system of longitudinal framing, of which 35 were intended for carrying oil-fuel in bulk. It is of interest to note that, owing to the difficulty of obtaining a sufficient number of cylindrical boilers, the greater portion of the vessels built in America and all the wood vessels built in Canada during the war were fitted with water-tube boilers. Also a large proportion of the vessels built in America were fitted with geared turbines, most of them being of the double-reduction type. Besides their ordinary work, the surveyors rendered great assistance to the Admiralty in the design, construction, and production of special types of vessels, and also to the French Government in the inspection of shell steel, of which 1,401,114 tons were passed by the society's surveyors. More than 200 German vessels taken over under the peace terms have been surveyed by the

committee's surveyors. The collective capacity of new cold stores and extensions carried out under Lloyd's survey amounts to 7,500,000 cub. ft. The committee has also undertaken research work at its own expense, one of the subjects at present engaging the attention of the special sub-committee on research being the effect of a fluid cargo in the form of oil in bulk on the behaviour of a ship in a seaway, and the manner in which energy passes between the ship and the fluid in the holds. The report is voluminous, and it is only possible to touch upon a few of the leading items of interest.

THE new monthly *Conquest*, of which the first number has just been issued, will fill a want long felt by the British public for a magazine giving, in popular language, an account of the scientific and technical achievements of the day. Readers having a technical bent were obliged to glean what information they could from the technical journals proper, or, if they read French sufficiently well, to subscribe to a well-known French periodical which fulfils the same function. The first number contains well-written and illustrated articles on the running of the London tubes, the technique of film-making, the internal structure of metals (by Dr. Walter Rosenhain), and other interesting contributions.

The Cambridge University Press hopes to have vol. iii. of the "Cambridge British Flora" ready for publication before the end of the year. Other announcements of the same publishers are a new edition of Prof. A. H. Keane's "Man, Past and Present," completely revised and largely rewritten by Mrs. Quiggin, with the assistance of Dr. A. C. Haddon; "Pleasure—Unpleasure," an experimental investigation on the feeling-elements, Dr. A. Wohlgemuth; "Chemistry for Textile Students," Prof. B. North and N. Bland; "Machine Drawing for Electrical Engineers," E. Blythe; "Food Poisoning and Food Infections," Dr. W. G. Savage; "Practical Exercises on the Weather and Climate of the British Isles," W. F. Stacey; "The Physiology of Farm Animals, Part i. (General)," Dr. F. H. A. Marshall; "General Psychology," W. S. Hunter; "Practical Geometry," C. Godfrey and A. W. Siddons; and "The Elements of Analytical Conics," Dr. C. Davison. *The Library Press, Ltd.*, has nearly ready for inclusion in its Manufacturing Problem Series "The Management Problem," E. T. Elbourne, and in preparation "The Reorganisation Problem," J. E. Powell, and "The Workers' Problem," W. Wilkinson. *The S.P.C.K.* will publish "Woodcraft Scouting in Town and Suburb," the Rev. W. Bren ("Silver Wolf").

A CATALOGUE (No. 78) interesting not only by reason of its contents, but also from the fact that many of the volumes offered for sale are from the libraries of the late Prof. T. McKenny Hughes and Mr. W. E. Balston, and that the geological portion of the library of Dr. Henry Woodward is included, has just been circulated by Messrs. Dulau and Co., Ltd., 34-36 Margaret Street, W.1. The 1018 works listed range over the subjects of zoology, botany and horticulture, geology and palæontology, astronomy, physics, etc., geography and travel. Many scarce books are on sale, but the majority of the volumes offered are obtainable for reasonable prices.

READERS of NATURE on the look-out for bargains in books for personal use or for presents would do well to see the Catalogue (No. 183) just issued by Messrs. W. Heffer and Sons, Ltd., Cambridge. All the works listed are new copies, and the reductions in price from those at which they were originally published are in many cases remarkable. Most branches of literature are represented, and many well-known books of science of comparatively recent publication are included.

MR. F. EDWARDS, 83 High Street, Marylebone, W.1, has just published an illustrated Catalogue (No. 395) of valuable early English and foreign books. The sections most likely to appeal to readers of NATURE are those referring to works dealing with Africa, America, Medicine, Herbals, Husbandry, and Natural History.

THE Society of Glass Technology should have been included in the list of scientific societies founded in the last fifty years given in the jubilee issue of NATURE. The society was founded in November, 1916, and has 550 members. Its work has frequently received favourable notice in our columns.

OUR ASTRONOMICAL COLUMN.

LARGE FIREBALL.—On November 2, at 7.6 p.m., a fireball of considerable brilliancy was seen by Mr. C. P. Adamson, of Wimborne, Dorset. Its observed flight was from 40°+7° to 51°+4°, and it had an extremely slow motion, its visible duration being carefully estimated as five seconds. The nucleus left a short train behind it.

The same object was observed by Dr. Cowper at Shanklin, Isle of Wight. The meteor was comparable with a football in regard to apparent size and shape. It fell in due east in a nearly vertical direction.

From these details it is not possible to deduce exact values for the height, etc., and further observations are required. Probably the radiant was at 312°+14°; and the height, 56 to 29 miles; path, 39 miles; and velocity, 10 miles. The object was over France in the region 45 miles east of Boulogne.

COMETS.—Mr. Sassaki, of Kyoto, Japan, discovered a comet on October 25 in R.A. 20h. 17m. 20s., south declination 27° 11′, the G.M.T. being October 24d. 23h. It was reobserved on November 9 by M. Schaumasse at the Nice Observatory, and was then found to be identical with Finlay's periodic comet, for which the Nice Observatory had already published a search ephemeris. As the comet's period is close to 6½ years, it is well placed every thirteen years, and usually escapes observation at the intervening return. On November 11 it approached the earth within some 15,000,000 miles, its apparent magnitude being 9·0. The following is an ephemeris for Greenwich midnight :—

		R.A.	N. Decl.	Log r	Log Δ
		h. m. s.	° ′		
Nov.	21 ...	0 35 0	5 15	0·0606	9·3149
	25 ...	1 4 20	9 24	0·0713	9·3657
	29 ...	1 28 4	12 38	0·0818	9·4166
Dec.	3 ...	1 48 4	15 7	0·0920	9·4658
	7 ...	2 6 12	17 1	0·1020	9·5140

The following is a continuation of the ephemeris of Schaumasse's periodic comet 1911 VII. for Greenwich midnight. The magnitude is about 12·5 :—

		R.A.	N. Decl.	Log r	Log Δ
		h. m. s.	° ′		
Nov.	19 ...	13 15 41	2 32	0·1081	0·2671
	23 ...	13 28 47	1 28		
	27 ...	13 41 30	0 26	0·1198	0·2710
			S. Decl.		
Dec.	1 ...	13 53 51	0 34		
	5 ...	14 5 49	1 32	0·1329	0·2745

The above ephemerides do not claim great accuracy, and some sweeping may be necessary to find the comets.

Later.—The Finlay ephemeris needs corrections of −24m. R.A., −3° decl.

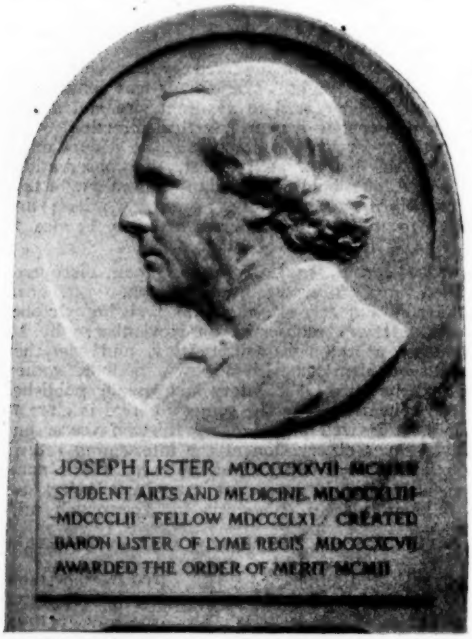
M. Ebell gives the following orbit of Kopff's comet 1919*a*, from observations 1919 July 31, August 20, September 16 (*Ast. Nach.*, 5016):—

T = 1919 June 28·210 G.M.T.	$\phi = 30°\ 56'\ 40{\cdot}6''$
$\omega = 19°\ 43'\ 51{\cdot}0''$	$\mu = 538{\cdot}904''$
$\Omega = 263°\ 48'\ 51{\cdot}4''$ 1919·0	$\log a = 0{\cdot}545664$
$i = 8°\ 41'\ 30{\cdot}1''$	Period = 6·5841 years

The mean observed period between 1906 and 1919 is 6·5766 years.

UNVEILING OF LISTER MEMORIAL TABLETS.

BRIEF mention was made last week of the unveiling at University College, London, of two bas-relief tablets in memory of Lord Lister, one of the most distinguished *alumni* of the college. There were present the Duke of Bedford (president of the Lister Memorial Committee), the president of the Royal Society, the president of the Royal College of Surgeons, Sir William Lister, the Misses Lister, and Miss Godlee (relatives of the late Lord Lister), the


JOSEPH LISTER MDCCCXXVII
STUDENT ARTS AND MEDICINE MDCCCXLIII
MDCCCLII FELLOW MDCCCLXI CREATED
BARON LISTER OF LYME REGIS MDCCCXCVII
AWARDED THE ORDER OF MERIT MCMII

Lister Memorial Tablet at University College, London. A similar tablet has been secured for University College Hospital, where Lister was student and house surgeon in 1843-52.

Vice-Chancellor of the University, the Provost of University College and Lady Foster, Sir John Bradford, Sir George Thane, Sir Thomas Barlow, Sir John Tweedy, Sir Ernest Hatch, and many others. The proceedings were opened by the Duke of Bedford, who referred to Lister's connection with University College, and commented upon the great value of Lister's presence in the House of Lords. Before unveiling the tablet destined to be erected at University College Hospital, where Lister was once house surgeon, Sir George Makins outlined the main events of Lister's life, the success of which was due to his thorough training as a student. Sir Joseph Thomson unveiled the tablet for University College. He said that Lister, one of the glories of British science, began his connection with the Royal Society at the early age of thirty-three, when he was elected a fellow. During Lister's five years' tenure of the presidency of the society much excellent administrative work was carried out, and this epoch saw the inception of several famous biological investigations organised by the society. The Provost (Sir Gregory Foster) then invited Sir Edwin Cooper Perry (the Vice-Chancellor), Sir George Thane, Sir Ernest Hatch, and Mr. Raymond Johnson to accept the tablets on behalf of the bodies they represented. Sir George Thane, in reply, mentioned that University College had that day been presented with one of Lister's prizes received whilst a student, and he expressed the hope that owners of Lister mementoes might present them to the college. On behalf of the memorial committee Sir John Tweedy conveyed the thanks of the subscribers to the sculptor, Prof. Havard Thomas.

THE BRITISH ASSOCIATION AT BOURNEMOUTH.

SECTION I.

PHYSIOLOGY.

OPENING ADDRESS (ABSTRACTED) BY PROF. D. NOËL PATON, M.D., F.R.S., PRESIDENT OF THE SECTION.

IN the advance of every science certain difficulties and dangers which must be encountered tend to make the progress of knowledge somewhat devious, somewhat zigzag in character.

(1) The study of the metabolism of proteins in the animal body, especially when they are considered as a source of energy, illustrates this in a striking manner. Liebig's teaching insisted on their prime importance. The investigations of Voit and of Fick and Wislicenus—unsatisfactory as the latter were—caused a swing to the other extreme, to the view that carbohydrates, not proteins, are the main source of energy. The work of Pflüger and of his school brought about a temporary swing back to Liebig's teaching. Only when it became possible to study the respiratory exchanges along with the excretion of nitrogen was a true knowledge gained of the relative importance of proteins and of the other two proximate principles.

(2) As regards the use of proteins in the building and repair of the tissues, progress has been more direct, and has ultimately led to the recognition of the importance of the constituent amino-acids as the "building stones" of the proteins. In this connection the importance of the diamino-acids lysin, histidin, and arginin must be recognised. Their presence has been shown to be necessary for growth. The presence of guanidin in the arginin molecule requires more attention than it has yet received.

(3) An aspect of protein metabolism which has been more recently elucidated is the physiological activity of the constituent amino-acids in explaining the stimulating action—the specific dynamic action—of proteins upon the general metabolism and upon heat production.

The evidence of whether guanidin may be a product manifesting a physiological action in the body is worthy of study. The investigations of Kossel and Dakin and the earlier work of Thompson do not negative the probability of the liberation of guanidin from arginin in muscle, while the more recent work of Inouye and of Thompson indicate that guanidin may be split off from arginin. The formation of guanidin, either free or combined, from non-protein sources was demonstrated by Burns to occur in the hen's egg during

the first twelve days of incubation up to the time of the appearance of creatin. That the cholin of the lecithin of the yolk is the precursor is rendered probable by the evidence adduced by Reisser and by Baumann Hines and Marker that creatin is formed from cholin.

That free methyl-guanidin is a normal constituent of muscle has been shown by the work of various investigators, and these results have been confirmed recently by Henderson. It is a normal constituent of the urine, even of such animals as the horse, which lives upon a creatin-free diet.

Guanidin and methyl-guanidin have marked physiological actions. They stimulate the efferent neurons of the spinal cord, causing tremors, jerkings, and extensor tonus. In large doses applied to the spinal cord, they paralyse. On the nerve-endings in muscle they have first a stimulating effect, so that the electrical excitability is increased, but later and in large doses they have a curare-like action. The symptoms are similar to those following ablation of the parathyreoids and to those of idiopathic tetany in children. In the blood and in the urine of parathyreoid ectomised dogs and in the urine of children with tetany, Burns and Sharpe demonstrated an enormous increase in the amount of guanidin present, an increase to which Koch had previously directed attention.

The conclusion seems to be that, under normal conditions, free methyl-guanidin maintains a tonic action on the efferent neurons and so on the muscles, and that the amount of guanidin is controlled by the parathyreoids.

The few observations so far made point to the excretion unchanged of only a part of injected guanidin. A possible explanation of this seems to be that part is linked with acetic acid and so converted to creatin and then rendered inert.

Previous work on the formation of creatin from glycocyamin, guanidin acetic acid, renders this probable. Recently in my laboratory Wishart has found a distinct increase in the creatin content of the muscles after the injection of guanidin sulphate, thus proving the conversion.

The nature of the combination of creatin in muscle is not yet known. Folin maintains that creatin is an integral part of the muscle substance, and that it is liberated as muscle dies and disintegrates. Evidence of this is lacking, and some recent experiments by Wishart show that in muscle frozen during life and extracted near the freezing-point the creatin content is the same as in muscle treated in the usual way. Folin's own work on the concentration of creatin in muscle does not seem to support his theory.

In the light of these results and of this view of the mode of formation of creatin from guanidin, what is the significance of the creatin which appears in the urine? This problem may best be investigated in animals in which the question of the relationship of creatin to creatinin need not be considered. Meissner in 1868 maintained that this is the case in birds, and his conclusion I verified in 1910. It has since been further substantiated by the work of Thompson. In birds during fasting the excretion of creatin is increased, just as in mammals the excretion of the combined creatin and creatinin is generally increased. Myers and Fine claim that the creatin excreted is derived from the creatin present in muscle at the beginning of the fast, while Stanley Benedict and Osterberg maintain that there is a constant fresh formation of creatin. The experimental basis of the latter conclusion seems to be unsubstantial, since they administered protein containing arginin and therefore guanidin, from which the creatin might have been formed.

In 1910 I maintained that, from the amount of creatin excreted by the bird during a fast, the amount of muscle disintegrated might be calculated. Whether the liberated creatin is simply excreted, or whether its resynthesis into muscles is prevented, the amount in the urine indicates the breakdown and non-regeneration of muscle, *i.e.* the *actual* disintegration. Hence a study of the relationship of the creatin nitrogen to the total nitrogen excreted enables a conclusion to be drawn as to whether the loss is falling chiefly upon muscle or upon other organs of the body. A study of the metabolism of the bird in fasting shows that such conclusions may be drawn, and, accepting Folin's most recent view of the significance of urinary creatin and creatinin, the excretion of the nitrogen in these substances, taken along with the total excretion of nitrogen, affords a means of elucidating further the progress of protein metabolism in fasting.

The work of Cathcart and others seems to show that creatin, in the presence of carbohydrates, may be resynthesised into the muscle substance. This in no way invalidates the view that it is formed to detoxicate guanidin. Lecithin, which is undoubtedly used in the construction of the tissues, plays a like part in detoxicating cholin.

As regards the relationship of creatin to creatinin, in spite of the very considerable literature which has appeared upon the subject, our knowledge has advanced little since the time of Meissner. The mass of evidence seems to favour the view that the creatinin daily excreted is derived from the creatin of muscle, but that the power of conversion is very limited, and that it varies in different individuals and in different species of animal.

The considerations here adduced seem to point to the conclusions :—(1) That creatin is formed from excess guanidin or methyl-guanidin in order to limit the toxic action of these; (2) that it is to a limited extent stored in muscle, any excess being excreted in the urine, either unchanged as in the bird, or in the form of creatinin in the mammal; (3) that during fasting and in the absence of carbohydrates it is liberated as the muscle disintegrates; and (4) that it may be recombined into the muscle molecule if the supply of carbohydrates is adequate.

RADIOTELEGRAPHY DURING THE SOLAR ECLIPSE OF MAY 29.[1]

IN connection with the solar eclipse of May 29 the committee arranged for the carrying out of experiments on the effect of the eclipse on signals transmitted across the central line. The British Admiralty stations at Ascension and the Azores transmitted continuously during the transit of the umbra across the Atlantic Ocean. Observing stations north of the equator were for the most part asked to listen to Ascension for at least an hour round about the time when the umbra passed between themselves and Ascension; observers south of the equator were asked for the most part to listen to the Azores. Certain selected stations north of the equator were also asked to listen to the Azores, so as to afford check observations upon the variations which might be observed in signals passing across the central line of the eclipse, and, similarly, selected stations south of the central line were asked to listen to Ascension. The American station at Sayville also transmitted a programme during a portion of the period of the eclipse, and arrangements were made for special experiments between Darien and the Falklands, and between an Egyptian station and a South African station.

[1] Report of a Committee of the British Association presented to Section A at the Bournemouth meeting, September 1919.

The main portion of the experiment hinged upon Ascension. The umbral cone passed from west to east, and was expected to affect in succession the strength in which signals were received at such stations as Demerara, Jamaica, the stations on the coast of the United States and Canada, stations in Ireland, England, France, Italy, the Mediterranean, and Egypt.

The shadow of the moon struck the earth first at dawn on the coast of South America and swept across the continent in the course of half an hour, at first with enormous velocity, but losing speed as the Atlantic Ocean was approached. About the middle of the Atlantic Ocean and near the equator the speed of the shadow was about one-third of a mile per second. On crossing the African continent from the Gulf of Guinea to the Mozambique Channel the speed gradually increased, and the eclipse finished at sunset near Madagascar. The effects of the moving shadow were investigated under three heads:—

(1) Strays.

(2) Signals not crossing the denser parts of the shadow.

(3) Signals crossing through or near the umbra.

Strays.

These were bad on the day of the eclipse and on the preceding day in Europe, North America, and temperate latitudes on the Atlantic Ocean. They were very few in Central and South America and in the central equatorial Atlantic. In Central America the conditions were exceptional meteorologically, the day having less rain than nearly every day of the preceding three weeks. The preliminary survey of the results recorded throughout the part of the globe reaching from Constantinople to Rio de Janeiro suggests that there was no outstanding occurrence in regard to frequency or intensity of strays that could be directly ascribed to the passage of the shadow.

Signals not Traversing the Dense Shadow.

Many observations were made in northern Europe and America on the signals from the Azores, which were arc-signals of 4700 metres wave-length. The observing points extended from Berlin through Holland, France, Italy, Spain, and Great Britain to stations near the Atlantic coast of the United States. There were no unusual variations in the strength of the signals from the Azores.

Another class of experiment comes under this heading. It was suggested by the effect sometimes observed at sunset or sunrise, in which the twilight band when on one side of a transmitting station appears to strengthen as if by reflection the waves received at a station on the other side of the transmitting station. In order to test whether such reflections occurred during an eclipse certain stations on the south of the central line of the eclipse were asked to listen to Ascension, which was also south of the central line. The stations at Durban and Port Nolloth (South-West Africa) found no trace of the effect, and, in fact, the former concluded that the signals from Ascension were rather worse after the eclipse began. An analogous experiment on the northern side was carried out by one of the Malta stations and also at Rosyth, listening to Cairo, with similar conclusions.

Effect of Signals Passing across the Central Line.

Arrangements were made for the transmission of signals from the Darien station of the Panama Canal zone, and several stations in South America attempted to receive the signals. The report from the Falkland Islands has not yet come to hand, and the other stations in South America did not succeed in picking up the signals. The only observation made on the earlier stages of the eclipse are those of Demerara listening to Ascension. Fluctuations in signal strength are reported, but no steady increase or decrease in strength. Ships at sea within the penumbra report a strengthening of all signals during the eclipse. The most striking results were obtained at some of the stations in France, Malta, and Teneriffe. At Meudon and at Rousillon the signals from Ascension were received practically only while the eclipse was in progress. Both Malta and Teneriffe found that the eclipse produced a great improvement in the strength of signals. On the other hand, Durban was unable to pick up Cairo, though this is usually possible, but Aden was picked up with greater intensity than normal. On the whole, the records show that the improvement in signal strength reached its highest value long before the umbra intervened between the stations, and this value persisted after the umbra had passed; that is to say, if ionising processes are the cause of the change in the strength of signals, the results indicate that the processes are practically fully accomplished in a given region of the air before the arrival of the umbra at that place, so that there appears to be nothing left for the umbra to do in the few minutes of complete shadow it brings.

The thanks of the committee are due especially to the Admiralty for arranging that their stations at Ascension and the Azores should transmit the necessary signals, and also to the American Government for making similar arrangements regarding Savville and Darien. Thanks are due also to the American, French, and Italian Governments, the Admiralty, the War Office, the Air Ministry, and Marconi's Wireless Telegraph Co., Ltd., for undertaking observations and recording the variations in signal strength.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The council of the Senate reports that, after consultation with Sir W. J. Pope, it is considered desirable to establish a professorship of physical chemistry, the stipend of 1000*l*. per annum to be furnished out of the benefaction of the British Oil Companies.

The General Board of Studies has recommended the appointment of Mr. A. Amos, of Downing College, as University lecturer in agriculture. This appointment is proposed in view of the new scheme of study in agriculture, extending over three years, and the large increase of students in the department of agriculture.

GLASGOW.—President Poincaré was installed as Rector of the University on November 14, and delivered his rectorial address in English to an assembly of four thousand students and other members and friends of the University in St. Andrews Hall. The proceedings were conducted in admirable order, the students recognising that M. Poincaré was not only their Rector, but also the honoured chief of an Allied State, visiting this country as his Majesty's guest. The Vice-Chancellor, Sir Donald MacAlister, K.C.B., conferred on him the degree of LL.D. *honoris causa* before the installation. The Vice-Chancellor wore the Cross of Commander of the Legion of Honour, with which the President had privately invested him before the public ceremony.

At a meeting of the University Court held afterwards, the Rector in the chair, a number of important gifts to the University were announced. Among them were contributions amounting to about 20,000*l*. for the erection of a memorial chapel in commemoration

of graduates and students who had fallen in the war; and 2000*l.* from Mr. Bonar Law and other heirs of the late Mr. J. R. K. Law, of Glasgow, for the foundation of a post-graduate studentship in applied science, to be held by bachelors of science pursuing advanced study or research at universities or scientific institutions in Canada, the United States, or France. The Rector was also asked to accept, on behalf of the French Government, a collection of about 500 volumes, chiefly Scottish, illustrative of the ancient Franco-Scottish alliance. These had been contributed by members of the University as a fraternal gift to the University of Nancy, in M. Poincaré's native province of Lorraine, the library of which had been completely destroyed by a German incendiary bomb in October, 1918, a few days before the armistice. The Rector accepted the gift, and presented to the University of Glasgow a fine Sèvres vase for the Hunterian Museum as a souvenir of his visit. In the afternoon President Poincaré was made an honorary freeman of the City of Glasgow.

Mr. John T. Cargill has offered the University a gift of 20,000*l.* to found a chair of applied physics.

DR. R. H. PICKARD, F.R.S., principal of the Municipal Technical School, Blackburn, has been appointed principal of the Battersea Polytechnic.

MRS. MARIA LOUISA MEDLEY has bequeathed 20,000*l.* to the University of Oxford to be applied for a George Webb Medley scholarship for the promotion of the study of political economy.

LORD MILNER, Secretary of State for the Colonies, has appointed a Committee to consider whether the staff of the Agricultural Departments in the Colonial Services is adequate, and, if necessary, to recommend increases of staff; to consider whether the rates of salary offered to the agricultural staff are adequate, and, if necessary, to suggest improvements; and to make recommendations for improving the arrangements for recruiting agricultural staffs for the Colonies. The members of the Committee are:—Sir Herbert Read, Assistant Under-Secretary, Colonial Office (chairman); Lt.-Col. Sir David Prain, director of the Royal Botanic Gardens, Kew; Sir Henry Birchenough, chairman of the Empire Cotton-growing Committee; Prof. J. B. Farmer, professor of botany, Imperial College of Science; Sir Francis Watts, Imperial Commissioner of Agriculture for the West Indies; Major R. D. Furse, Assistant Private Secretary (Appointments), Colonial Office; and Mr. F. L. Sidebotham, of the Colonial Office (secretary).

THE KING has approved the appointment of Royal Commissioners to consider the applications which have been made by the Universities of Oxford and Cambridge for financial assistance from the State, and for this purpose to inquire into the financial resources of the Universities and of the colleges and halls therein, into the administration and application of these resources, into the government of the Universities, and into the relations of the colleges and halls to the Universities and to each other, and to make recommendations. The Commissioners constitute one body, but are authorised to sit for purposes of inquiry in three separate committees. They consist of the following:—*Chairman of Commission:* Mr. H. H. Asquith. *Oxford Committee:* Mr. H. H. Asquith (chairman), Lord Chalmers, Sir John A. Simon, the Very Rev. T. B. Strong (Dean of Christ Church, Oxford), Sir H. A. Miers (Vice-Chancellor of Manchester University), Prof. W. H. Bragg (Quain professor of physics in London University), Prof. W. G. S. Adams (Gladstone professor of political theory and institutions, Oxford), Miss Emily Penrose (Principal of Somerville College, Oxford), and Mr. Albert Mansbridge. *Cambridge Committee:* Mr. G. W. Balfour (chairman), Mr. Arthur Henderson, Sir W. Morley Fletcher (fellow of Trinity College, Cambridge), Sir Horace Darwin, Mr. G. M. Trevelyan, Dr. H. K. Anderson (Master of Gonville and Caius College, Cambridge), Miss B. A. Clough (Vice-Principal of Newnham College, Cambridge), Dr. Montagu R. James (Provost of Eton College), and Prof. A. Schuster (secretary of the Royal Society). *Committee on Estates Management:* Lord Ernle (chairman), the Hon. Edward Strutt, Sir Howard Frank, Sir J. H. Oakley (past-president of the Surveyors' Institution), and Mr. H. M. Cobb (fellow and member of the council of the Surveyors' Institution). The secretary of the Commission is Mr. C. L. Stocks. There are three assistant secretaries, namely:—For the Oxford Committee, Mr. Marcus N. Tod, fellow and tutor of Oriel College, Oxford; for the Cambridge Committee, Mr. Edward Bullough, fellow of Gonville and Caius College, Cambridge; and for the Estates Committee, Mr. C. B. Marshall. The offices of the Commission are at 2 Queen Anne's Gate Buildings, Queen Anne's Gate, S.W.1.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, October 24.—Prof. C. H. Lees, president, in the chair.—Dr. N. W. **McLachlan**: The effect of pressure and temperature on a meter for measuring the rate of flow of a gas. The theory of an instrument for measuring the rate of flow of a gas is outlined, the effects of variation in the temperature and pressure of the gas being taken into consideration. This theory is tested experimentally for pressures varying from 1250 to 250 mm. Hg, and for temperatures from 10° C. to 100° C. It is found to be fairly accurate. The results are applied to the measurement of the rate of flow of gas on an aeroplane in the upper atmosphere, where a reduction in temperature and pressure is encountered. It is shown that the instrument reading for a certain N.T.P. volume of gas depends on the altitude, but that this volume can be obtained by using a correction factor.—Capt. J. H. **Shaxby**: A cheap and simple microbalance. The instrument, devised for bacteriological use, had to be cheap and moderately robust. It consists of a long horizontal fibre joining the lower ends of two vertical beams, each pivoted very little above its centre of mass. A small weight acting at the middle of the fibre thus causes a considerable depression. This is read off by arranging a slider on a vertical millimetre scale about 2 ft. in front, so that the middle of the fibre and a second short fibre placed just behind it are in line with a "peephole" on the slider. Adjustment is provided for quickly and largely altering the sensitiveness. The deflections are converted to masses by the use of calibrating weights. The apparatus is built up from a "Meccano" set.—J. W. T. **Walsh**: The resolution of a curve into a number of exponential components. The paper gives a method for the resolution of a curve of the compound exponential form

$$B = \sum_{1}^{n} a_1 e^{-\lambda_1 t}$$

into its components, the values of a and λ for the n different exponential terms being found from $2n$ values of B equidistant along the axis of t. A method is also given for finding the most probable values of these constants from any number ($>2n$) of observed values of B taken at irregular intervals of t.

Aristotelian Society, November 3.—Prof. James Ward, president, in the chair.—The **President**: Inaugural address: In the beginning . . . The problem that the uni-

verse sets us is an inverse problem. But the two most distinguished philosophers amongst us, starting from the Absolute as their criterion, declare the whole world as we know it, including ourselves, as infected with contradictions, which are only resolved in the Absolute. Precisely how resolved we do not know, and never can know. But at least everything is blended and transformed into one perfect experience in which no finite centres of experience as such are respected or retained. Is the Absolute, then, making sport of us, it is asked, since the untransformed, discrepant "appearances," it would seem, must ever remain to perplex us? No, it is replied; for these appearances are the Absolute's revelation to us. Moreover, in the unification of our originally disjointed experiences which underlies all human development, and again in the ever-increasing mutual "transparency" of formally distinct individuals—who are thereby ever more and more enabled to think and feel and act as one—we can see the beginning of the process that in the Absolute is eternally accomplished. But, it was rejoined, the progress of knowledge shows no sign of reducing the categories of thought to the mere "adjective" with which, perhaps, it began. Nor does our advance to a higher unity show any tendency to replace stability and originality of character by mere "connections of content." In conclusion, it was urged that it is hopeless to attempt to begin from the point of view which only a *completed* philosophy could occupy. To advance continuously and be coherent—that should be our golden rule. The whole procedure would be tentative—that must always be the case with inverse problems. Crises, too, there would be again, as in the past; but such crises, after all, would only be cases of "sloughing an outgrown skin," not of radical disease. Philosophy on the whole had progressed; and so long as it followed the method which Nature herself observes—to make no leaps—why should it not progress still?

Mineralogical Society, November 4 (Anniversary Meeting).—Sir William P. Beale, Bart., president, in the chair.—Dr. W. R. **Schoeller** and A. R. **Powell**: Villamaninite, a new mineral. The new mineral, which occurs, disseminated in black grains and plates, with a distinct cleavage, and in small nodules with a radially fibrous structure, in a crystalline dolomite near Villamanin, Cármenes district, León province, Spain, has probably a composition corresponding with $(Cu,Ni,Co,Fe)(S,Se)_2$. Its streak is sooty-black, hardness $4\frac{1}{2}$, and specific gravity 4·4–4·5; it is opaque.—A. **Russell**: The occurrence of phenakite and scheelite at Wheal Cock, St. Just, Cornwall. The author found good specimens of these minerals in 1914 at Wheal Cock, which is the locality whence came the crystal (undoubtedly phenakite) described by Sowerby in 1804 as argilla electrica or white tourmaline. Phenakite was not known until 1833 as a distinct species.—L. J. **Spencer**: New crystal-forms on pyrites, calcite, and epidote. On pyrites the dyakis-dodecahedron (641) occurs as large, well-developed faces on five specimens, one of them from Traversella, Piedmont, and the others from coal-shales of unknown locality. On 424 crystallised specimens of pyrites in the British Museum collection, 35 crystal-forms were noted. Faces of the cube are present on 76·6 per cent. of the specimens, the octahedron on 62·7 per cent., the pentagonal-dodecahedron (210) on 54·7 per cent., and the dyakis-dodecahedron (321) on 36·1 per cent. As simple forms, not in combination with other forms, they are represented by 12, 2, $2\frac{1}{2}$, and $\frac{1}{2}$ per cent. respectively. The decomposition of specimens of pyrites in collections was discussed. Calcite, a clear scalenohedral crystal, probably from Iceland, consists of a combination of the two scalenohedra (201) and (12.0.7), both largely developed, and with an angle of only $4\frac{1}{2}°$ between corresponding faces. Epidote, a crystal, probably from Ala, Piedmont, closely resembling in appearance the yellow prismatic crystals of anatase, carries a minute face (134) (Dana's orientation) in addition to twenty other crystal-forms.—Dr. G. F. Herbert **Smith**: A curious crystal from the Binnental. The crystal, which was found with a few loose sartorite crystals in the Trechmann collection, is twinned and tabular in habit, and shows signs of corrosion. The symmetry is peculiar, since, although a face occurs at right angles to the prism edge, it is neither a plane nor a pole of symmetry, and the crystal appears to represent a new species of sulpharsenite.

MANCHESTER.

Literary and Philosophical Society, October 7.—Mr. Francis Jones, vice-president, in the chair.—Sir Henry A. **Miers**: The future of the Manchester Literary and Philosophical Society. Attention was especially directed to the urgent need in societies for informal discussions, a work performed by such societies in their pioneer days. With the increase of scientific knowledge the tendency has been for scientific people to segregate into special groups. As a result of this, the papers read at modern specialist societies are calculated to appeal only to experts. A reaction is indicated by recent attempts at co-operation between the humanities and sciences. Great work could be done by making the most recent advances in science understood by those who were not experts, and by promoting meetings at which new ideas can be expressed in language intelligible to all. There is danger of a scientific hierarchy, and of a cleavage between specialists and amateurs. Investigators might be encouraged to give popular expositions of their own discoveries to a general audience, in addition to the more severely scientific paper intended for publication.

PARIS.

Academy of Sciences, October 27.—M. Léon Guignard in the chair.—C. **Moureu** and A. **Lepape**: The stabilisation of acrolein. An empirical method of stabilisation. The crude aldehyde is shaken with 10 per cent. of its weight of dry sodium bicarbonate. The acidity is reduced to 5 per cent. of its original value, and the acrolein so produced is practically stable.—A. **Chatelet**: Hypercomplex numbers with associative and commutative multiplication.—E. T. **Bell**: Particular representations by some quadratic forms of Liouville.—P. **Chevenard**: The viscosity of steels at high temperatures. A chrome-nickel steel wire was maintained at a constant temperature in an atmosphere of nitrogen, and the elongation under a fixed load measured photographically as a function of the time.—H. **Vanderlinden**: Observations of Borrelly's comet 1919c. Measurements were made at the Royal Belgian Observatory at Uccle on October 18, 22, and 23. On October 22 the comet appeared as a nebulosity of 1′ diameter. The nucleus was clear, and of magnitude about 9.—J. **Volmat**: The application of aerial photography to hydrographic surveys. Photographs from an aeroplane of the sea-floor in the neighbourhood of Brest proved the great possibilities of this method of marine surveying. Several points of rock which had escaped previous careful surveys were discovered with ease.—L. **Majorana**: Experiments on gravitation.—E. **Perucca**: Plane waves laterally indefinite, with pendular vibrations, which reflection and refraction associate with one or two given analogous systems of incident waves.—H. **Muraour**: The comparison of explosion temperatures calculated starting from the specific heats with those calculated starting

with the explosive pressures.—M. **Chelle**: The transformation of hydrocyanic acid into thiocyanic acid in the course of cadaveric putrefactions; experiments made *in vitro*. In putrefactive phenomena hydrocyanic acid is in part transformed into thiocyanate. In some experiments *in vitro* with known quantities of cyanide added to normal blood, after ten days the hydrocyanic acid had apparently disappeared, but could be almost wholly recovered by oxidising the thiocyanate formed.—L. **Joleaud**: The tectonic of the neighbourhood of Tilouanet (Oran).—C. E. **Brazier**: The relations of the wind with gradient in the lower layers of the atmosphere.—J. **Ubach**: Observations made at Buenos Aires during the annular eclipse of the sun of December 3, 1918. Details of variations of the magnetic declination observed during the eclipse.—E. **Sollaud**: The influence of the conditions of the medium on the larvæ of *Palaemonetes varians microgenitor*.—J. **Nageotte**: Osteogenesis in grafts of dead cartilage.—A. **Paillot**: Karyokinetosis; new facts and general considerations.—A. **Marie**, C. **Levaditi**, and G. **Banu**: New attempts to transmit the treponeme of general paralysis to the rabbit.

BOOKS RECEIVED.

The Physiology of Muscular Exercise. By Prof. F. A. Bainbridge. Pp. ix+215. (London: Longmans and Co.) 10*s*. 6*d*. net.

A Course of Practical Chemistry for Agricultural Students. By H. A. D. Neville and L. F. Newman. Vol. ii., part 1. Pp. 122. (Cambridge: At the University Press.) 5*s*. net.

The Story Book of Science. By J. H. Fabre. Pp. 299. (London: Hodder and Stoughton.) 7*s*. 6*d*. net.

Modern Science and Materialism. By H. Elliot. Pp. vii+211. (London: Longmans and Co.) 7*s*. 6*d*. net.

Elements of Physics. By Dr. R. A. Houston. Pp. viii+221. (London: Longmans and Co.) 6*s*. net.

Mensuration for Marine and Mechanical Engineers. By J. W. Angles. Pp. xxvii+162. (London: Longmans and Co.) 5*s*. net.

Chemical Calculation Tables. By Prof. H. L. Wells. Second edition. Pp. v+43. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s*. 6*d*. net.

Food: Its Composition and Preparation. By M. T. Dowd and J. D. Jameson. Pp. viii+173. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s*. net.

Popular Oil Geology. By Prof. V. Ziegler. Pp. viii+149. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 11*s*. 6*d*. net.

Commercial Oils: Vegetable and Animal, with a Special Reference to Oriental Oils. By I. F. Laucks. Pp. viii+138. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s*. net.

Vital Statistics. By Prof. G. C. Whipple. Pp. xii+517. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 18*s*. 6*d*. net.

Lectures on Ten British Physicists of the Nineteenth Century. By A. Macfarlane. Edited by M. Merriman and R. S. Woodward. Pp. 144. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 7*s*. 6*d*. net.

Bacteriology and Mycology of Foods. By Dr. F. W. Tanner. Pp. vi+592+10 plates. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 28*s*. net.

A Text-book of Hygiene for Training Colleges. By M. Avery. Pp. xv+324. (London: Methuen and Co., Ltd.) 7*s*. 6*d*. net.

Unified Mathematics. By Prof. L. C. Karpinski, Prof. H. Y. Benedict, and Prof. J. W. Calhoun. Pp. viii+522. (London: G. G. Harrap and Co., Ltd.) 10*s*. 6*d*. net.

Groundwork of Surgery. (For First-Year Students.) By A. Cooke. Pp. viii+183. (Cambridge: W. Heffer and Sons, Ltd.)

Rückläufige Differenzierung und Entwicklung. By A. Cohen-Kysper. Pp. 85. (Leipzig: J. A. Barth.) 3 marks.

Handbook of Mineralogy, Blowpipe Analysis, and Geometrical Crystallography. By Prof. G. M. Butler. Pp. ix+311; v+80; viii+155. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 16*s*. 6*d*. net.

An Introduction to Theoretical and Applied Colloid Chemistry. By Dr. W. Ostwald. Translated by Prof. M. H. Fischer. Pp. xv+232. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 11*s*. 6*d*. net.

The Chemistry of Colloids. By Prof. R. Zsigmondy and Prof. E. B. Spear. And a Chapter on Colloidal Chemistry and Sanitation. By Dr. J. F. Norton. Pp. vii+288. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 13*s*. 6*d*. net.

A Handbook of Physics Measurements. By E. S. Ferry and others. Vol. i. Pp. ix+251. Vol. ii. Pp. x+233. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 9*s*. 6*d*. net each.

Engineering Education: Essays for English. Selected and edited by Prof. R. P. Baker. Pp. ix+185. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s*. net.

A Handbook to the Vertebrate Fauna of North Wales. By H. E. Forrest. Pp. v+106. (London: Witherby and Co.) 6*s*. net.

Thalassiophyta and the Subaerial Transmigration. By A. H. Church. Pp. 95. (London: Oxford University Press.) 3*s*. 6*d*. net.

A Synoptical List of the Accipitres. By H. Kirke Swann. Part ii. (London: J. Wheldon and Co.) 4*s*.

Chemistry from the Industrial Standpoint. By P. C. L. Thorne. Pp. xvi+244. (London: Hodder and Stoughton.) 4*s*. 6*d*. net.

Applied Botany. By G. S. M. Ellis. Pp. viii+248. (London: Hodder and Stoughton.) 4*s*. 6*d*. net.

Elementary Biology. By B. C. Gruenberg. Pp. x+528. (Boston and London: Ginn and Co.) 7*s*. net.

Radio-Diagnosis of Pleuro-Pulmonary Affections. By F. Barjon. Translated by Dr. J. A. Honeij. Pp. xix+183. (London: Oxford University Press.) 10*s*. 6*d*. net.

Elements of Vector Algebra. By Dr. L. Silberstein. Pp. vii+42. (London: Longmans and Co.) 5*s*. net.

Researches in Physical Optics. By Prof. R. W. Wood. Part ii. Resonance Radiation and Resonance Spectra. Pp. viii+184+x plates. (New York City: Columbia University Press.)

Practical Leather Chemistry. By A. Harvey. Pp. viii+207. (London: Crosby Lockwood and Son.) 15*s*. net.

A Practical Handbook of British Birds. Part 5. Pp. 273–336+2 plates. (London: Witherby and Co.) 4*s*. net.

Le Mythe des Symbiotes. By A. Lumière. Pp. xi+200. (Paris: Masson et Cie.) 6 francs net.

Manuel Pratique de Météorologie. By J. Rouch. Pp. viii+145+xiv plates. (Paris: Masson et Cie.) 6.50 francs net.

Toxines et Antitoxines. By M. Nicolle, E. Césari, and C. Jouan. Pp. viii+123. (Paris: Masson et Cie.) 5 francs net.

Anesthésie à la Stovaïne en Chirurgie et en Médecine

Vétérinaire. By G. Perol. Pp. 31+vi plates. (Paris: Masson et Cie.) 3 francs net.

Arcachon Ville de Santé. Monographie Scientifique et Médicale. By Dr. F. Lalesque. Pp. viii+798. (Paris: Masson et Cie.) 25 francs net.

The Oliver-Sharpey Lectures on the Feeding of Nations. By Prof. E. H. Starling. Pp. ix+146. (London: Longmans and Co.) 5*s*. net.

Chemistry and its Mysteries. By C. R. Gibson. Pp. 246. (London: Seeley, Service, and Co., Ltd.) 4*s*. 6*d*. net.

Submarine Warfare of To-day. By Lieut. C. W. Domville-Fife. Pp. 304. (London: Seeley, Service, and Co., Ltd.) 7*s*. 6*d*. net.

W. and A. K. Johnston's Modern Atlas of Commerce. Pp. 48. (Edinburgh: W. and A. K. Johnston, Ltd.; London: Macmillan and Co., Ltd.) 1*s*. 10*d*. net.

The Realities of Modern Science. By J. Mills. Pp. xi+327. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 10*s*. 6*d*. net.

Profit and Sport in British East Africa: Being a Second Edition, Revised and Enlarged, of "A Colony in the Making." By Capt. the Lord Cranworth. Pp. xvi+503. (London: Macmillan and Co., Ltd.) 21*s*. net.

Accounts Rendered of Work Done and Things Seen. By J. Y. Buchanan. Pp. lvii+435+3 plates. (Cambridge: At the University Press.) 21*s*. net.

Palæontology: Invertebrate. By H. Woods. Fifth edition. Pp. viii+411. (Cambridge: At the University Press.) 12*s*. 6*d*. net.

A Geographical Bibliography of British Ornithology from the Earliest Times to the End of 1918. By W. H. Mullens, H. Kirke Swann, and Rev. F. C. R. Jourdain. Part i. Pp. 96. (London: Witherby and Co.) 6*s*. net.

The Art of Anæsthesia. By Dr. P. J. Flagg. Second edition. Pp. xviii+367. (Philadelphia and London: J. B. Lippincott Co.) 18*s*. net.

Atlas of Operative Gynæcology. By Prof. B. C. Hirst. Pp. vi+202. (Philadelphia and London: J. B. Lippincott Co.) 30*s*. net.

The Mystery of Easter Island: The Story of an Expedition. By Mrs. Scoresby Routledge. Pp. xxi+404. (London: Sifton, Praed, and Co., Ltd.) 31*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 20.

ROYAL SOCIETY, at 4.30.—W. J. Johnston: A Linear Associative Algebra suitable for Electro-magnetic Relations and the Theory of Relativity.—Sir Joseph Larmor: Note on Mr. W. J. Johnston's Calculus for Generalised Relativity.—G. E. Bairsto: On the Variation with Frequency of the Conductivity and Dielectric Constant of Dielectrics for High Frequency Oscillations.—F. J. W. Whipple: Equal Parallel Cylindrical Conductors in Electrical Problems.—G. A. Schott: The Scattering of X- and γ-Rays by Rings of Electrons. A Crucial Test of the Electron Ring Theory of Atoms.

ROYAL SOCIETY OF MEDICINE (Dermatology Section), at 4.30.—*Cases*:—Dr. Bunch: Case of Linear Morphœa.—Dr. MacLeod: (1) Melanotic Lesion on Sole of Foot; (2) Case for Diagnosis.—Dr. Barber: (1) Case for Diagnosis-Blastomycosis (?); (2) Erythrodermie Congenitale Ichtyosiforme.

LINNEAN SOCIETY, at 5.—K. Patten: Plants collected in Mesopotamia and in Southern India.—C. C. Lacaita: *Orchis maculata* from Monte Gargano, Italy.—Dr. G. C. Druce: Two New British Plants.—Miss Trower: Paintings of British *Rubi*.—Prof. R. C. McLean: Sex and Soma.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.—H. L. Sulman: A Contribution to the Study of Flotation.

CHILD STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Dr. D. Forsyth: The Pre-School Girl.

CHEMICAL SOCIETY (and Informal Meeting), at 8.

FRIDAY, NOVEMBER 21.

ROYAL SOCIETY OF MEDICINE (Otology Section), at 5.—H. Tilley: Presidential Address—A Plea for the Better Education of the Medical Student in Oto-Rhino-Laryngology.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—C. G. Conradi: The Present Position of Mechanical Road Traction.

INSTITUTION OF ELECTRICAL ENGINEERS (Students' Meeting) (at the City and Guilds (Engineering) College), at 7.—A. P. Trotter: Opening Address.

JUNIOR INSTITUTION OF ENGINEERS (at Royal Society of Arts), at 7.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section), at 8.30.—Dr. G. B. Batten: Apparatus for Obtaining Morton Wave Current and Static Modalities from a Coil.—Major G. Cooper: The Artificial Stimulation of Muscle, with Demonstration of a New Form of Faradic Coil.

MONDAY, NOVEMBER 24.

INSTITUTE OF ACTUARIES, at 5.—Dr. C. E. Howell: The Reversionary (or Prospective) and Collective Methods of Valuing Widows' Funds, with some Notes on the Valuation of the Church of Ireland Widows' and Orphans' Fund.

TUESDAY, NOVEMBER 25.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 5.30.—L. Gaster: The Works of Lambert.—The Hon. Secretary: Report on Progress.

INSTITUTION OF CIVIL ENGINEERS (Extra Meeting), at 5.30.—H. H. Gordon: Metropolitan Road and Rail Traffic.

ROYAL ANTHROPOLOGICAL INSTITUTION, at 8.15.—Dr. W. Strong: Some Personal Experiences in British New Guinea.

WEDNESDAY, NOVEMBER 26.

ROYAL UNITED SERVICE INSTITUTION, at 3.—Maj.-Gen. Sir George Aston: Combined Operations.

ROYAL SOCIETY OF ARTS, at 4.30.—Dr. H. B. Morse: British Trade in China.

WIRELESS SOCIETY OF LONDON (at Institution of Civil Engineers), at 6.—J. Scott-Taggart: A System for the Reception of Continuous Waves.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 8.—G. Brewer: Some Kite-Balloon Experiments.

THURSDAY, NOVEMBER 27.

ROYAL COLLEGE OF SURGEONS, at 3.—Annual Meeting of Fellows and Members.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—C. C. Paterson, J. W. T. Walsh, A. K. Taylor, and W. Barnett: Carbon Arcs for Searchlights.

FRIDAY, NOVEMBER 28.

PHYSICAL SOCIETY, at 5.—Discussion on Lubrication. To be opened by Dr. T. E. Stanton. Speakers include Principal Skinner, W. B. Hardy, F. W. Lanchester, and H. M. Martin. Visitors are invited to this Meeting.

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Editorial and Publishing Offices:
MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.